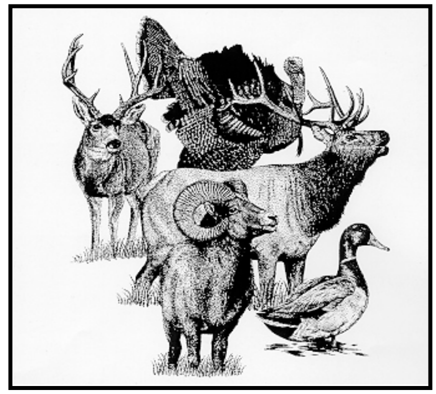
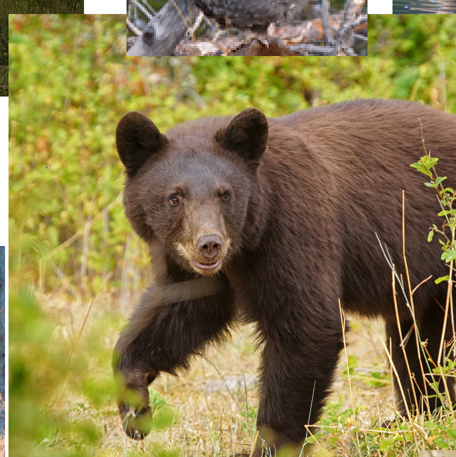
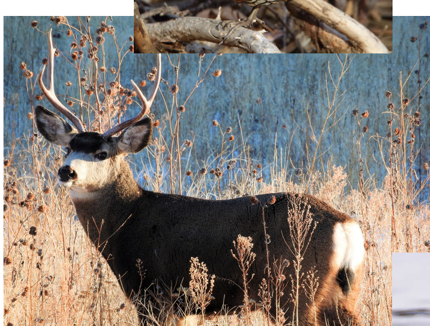
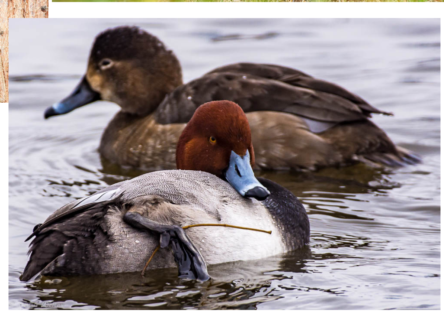
STATE OF WASHINGTON

2019 Game Status and Trend Report









Washington Department of FISH and WILDLIFE

AN OFFICIAL PUBLICATION OF THE STATE OF WASHINGTON

2019 GAME STATUS AND TREND REPORT

July 1, 2018 – June 30, 2019

Washington Department of Fish and Wildlife
1111 Washington Street, SE
Olympia, WA 98501

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

This report should be cited as:

Washington Department of Fish and Wildlife. 2019. 2019 Game Status and Trend Report. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, Washington, USA.

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Deer

Blue Mountains Mule Deer Management Zone

MARK VEKASY, Wildlife Biologist
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Introduction

The Blue Mountains Mule Deer Management Zone (MDMZ) is located in southeast Washington and consists of 13 GMUs (145, 149, 154, 157, 162, 163, 166, 169, 172, 175, 178, 181, and 186; Figure 1), with GMU 157 being closed to human entry with no mule deer harvest opportunity.

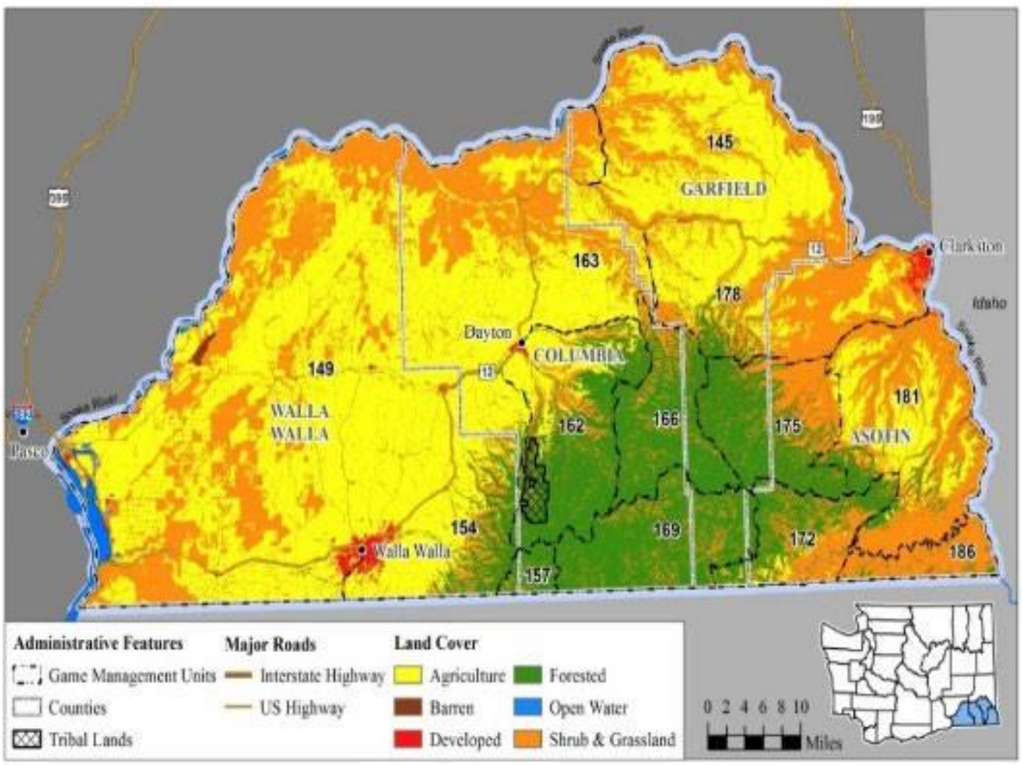


Figure 1. GMUs and generalized land cover types within the Blue Mountains MDMZ.

Management Guidelines and Objectives

The Department's objective within this MDMZ is to maintain a stable population based on abundance and harvest estimates. Additional management objectives include managing for a post-hunt population with a sex ratio of 15-19 bucks:100 does in predominantly agricultural areas and 20-24 bucks:100 does in predominantly public land units.

Population Surveys

Up until 2012, we conducted surveys following sightability protocols (procedure to statistically estimate a population in the survey area) in small geographic areas to obtain sufficient counts of deer for ratio estimates of fawns and bucks in the population, but these counts were not sufficient to develop population estimates. During 2012-2014, we increased the geographic area of surveys to obtain sub-population estimates in large GMU's or GMU groups. Using the results from these surveys, we identified priority survey areas based on suspected deer movements, similar harvest statistics, and generalized geographic boundaries, and have focused recent surveys in the area of greatest winter mule deer concentrations. This area is generally north of State Hwy 12, from Alpowa Creek across District 3 to Wallula Junction.

Chronology of recent surveys

December 2012-2014: Post-hunt aerial sightability surveys in portions of the Snake River Breaks and the agricultural and grassland ecoregion. Estimated population of approximately 20,000 mule deer in the survey areas. Individual sightability surveys estimates: 3,353 (90% CI = 2,980-3,726) for most of GMU 181 in 2012; 10,799 (90% CI = 9,986-11,612) for GMU 145 and portions of adjacent units; 6,052 (90% CI = 5,719-6,385) for approximately half of GMU 149.

December 2015-2016: Post-hunt road surveys for ratio estimates across GMUs with road access and open habitats. Counted 822 and 584 mule deer in 2015 and 2016, estimated 12 and 14 bucks:100 does and 60 and 50 fawns:100 does, respectively.

December 2017: Post-hunt aerial sightability surveys in western, northcentral, and northeast portions of the District. Counted 8,221 mule deer in 1,141 groups across 55 of 139 subunits. Estimated population of 18,368 mule deer (95% CI = 15,728 - 22,293), with estimated ratio of 14.1 bucks:100 does (95% CI = 11.2-17.0) and 49.6 fawns:100 does (95% CI = 43.3-56.0).

December 2018: Post-hunt aerial sightability survey, survey area consistent with 2017 surveys. Counted 7,287 mule deer in 1,032 groups across 44 of 139 subunits. Estimated population of 18,415 mule deer (95% CI = 15,744 – 22,224), with estimated ratio of 22.6 bucks:100 does (95% CI = 18.1-27.0) and 47.0 fawns:100 does (95% CI = 41.2-52.8).

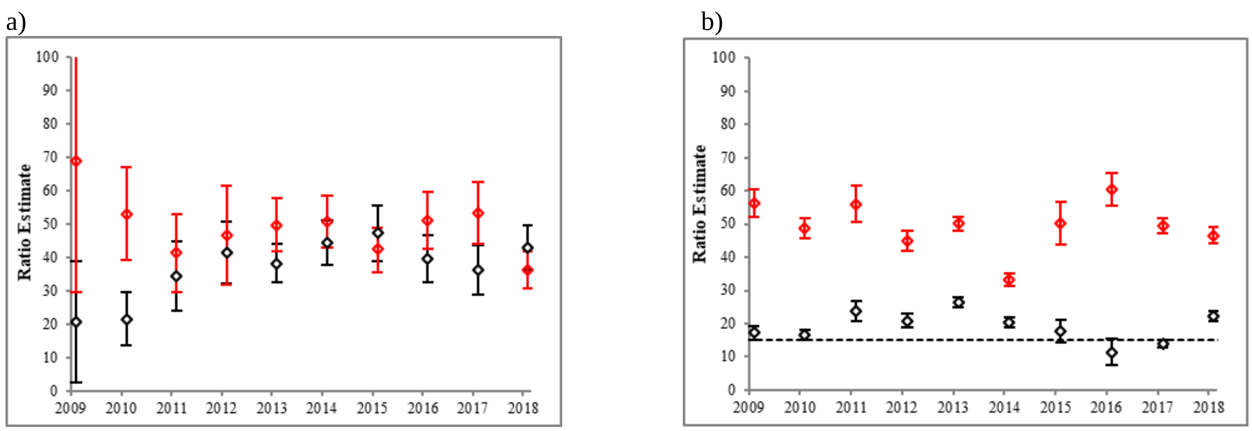
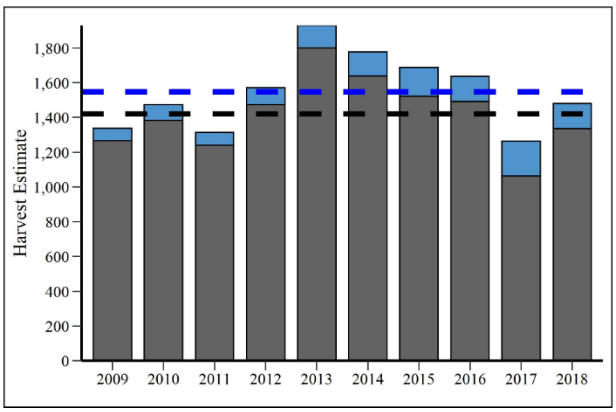


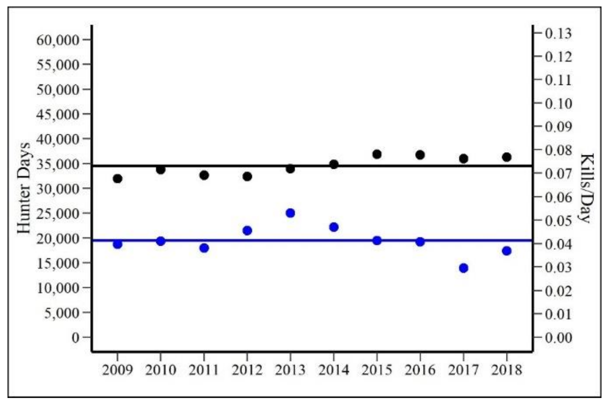
Figure 2. Estimates of buck (black) and fawn (red) ratios per 100 does for, (a) pre-hunt (ground-based) and (b) post-hunt (ground and aerial) surveys in the Blue Mountains MDMZ, 2009–2018.

Hunting Seasons and Recreational Harvest

Harvest estimates from 2009-2018 general seasons (Figure 3a) have been variable over that 10-year time frame but exhibit a recent 5-year downward trend. While hunter effort (hunter days; Figure 3b) has remained consistent, harvest rate (kills/day; Figure 3b) has mirrored recent downward trends in total harvest. Some of this downward trend could be related to increased anterless permits being offered in GMUs 145 and 149 putting pressure on the doe segment of the population. However, in GMU 145, we went from 75 permits offered in 2012, to 155 permits in 2016, and in GMU 149, we went from 0 permits to 155 permits over the same time period; these permit increases resulted in approximately 70 more antlerless deer being harvested per year, which on a population level is likely to have very little effect. These GMUs exhibited improving harvest metrics through 2013, along with an increase in deer damage complaints, which prompted the increase in antlerless permits. Hunter success and harvest per unit effort (HPUE), although having recently declined in those 2 GMUs, remains relatively high, but antlerless permit numbers may need to be reduced if the current downward trend continues. Hunter success and HPUE were higher in both GMUs for the 2018 season, maintaining a recovering trend in GMU 145 and halting a declining trend in GMU 149. GMU 149 on average accounts for 33% of the mule deer harvest and changes in this GMU have the greatest impact on the overall trends across the District. It is important to note that hunter days and kills/day represent all deer hunting in the zone, including white-tailed deer.



a)



b)

Figure 3. Harvest estimates (columns) and 10-yr means (dashed lines) for (a) General BM Zone Harvest (gray) and General + Permit BM Zone Harvest (blue); and (b) general season estimates (points) and 10-yr means (solid lines) for hunter days (black) and harvest/day (blue); in the Blue Mountains MDMZ, 2009–2018.

Survival and Mortality

No estimates of pregnancy, fetal, or survival rates are available for mule deer herds in the Blue Mountains MDMZ. We are currently trying to maintain 50 radio-collared does across the recent survey area, which should provide information on doe survival as well as identifying range and movement patterns. We identified high mortality during the first full winter of collar deployments, which we suspect was related to difficult late winter conditions resulting in poor body condition, capture-related stress, and predation. We suspect this was an unusual convergence of events and expect to see higher doe survival rates for the duration the radio-collars' performance (approx. 4 years). We plan to re-deploy collars retrieved from mortalities during the upcoming winter.

In addition to legal hunter harvest, other potential sources of mule deer mortality include predators such as cougars, coyotes, wolves, and black bears, and to a lesser extent, bobcats, golden eagles, and domestic dogs. Collisions with vehicles, over-winter starvation, and poaching can also be significant causes of mortality. While these mortality sources may influence population abundance, particularly in the forested habitats, habitat condition and availability likely have the greatest impact to mule deer populations, particularly here in the Blue Mountains MDMZ where most of the deer population at lower elevation is likely to be summer range limited.

Habitat

Limited habitat is the major impediment to increasing deer numbers and hunting opportunity within the Blue Mountains MDMZ. The Blue Mountains MDMZ has been altered by landscape changes including conversion to croplands, wildfire suppression and burning, road construction, invasion of noxious weeds, extensive wind power development, and urban-suburban development. Solar development is another emerging threat to habitat, with over 2,000 acres proposed for development in Garfield County. Although no single factor has had a direct, large-scale effect on mule deer populations in the Blue Mountains, the cumulative effects of such alterations have likely been detrimental to mule deer habitat and populations over time.

Human-Wildlife Interaction

The agricultural damage prevention program managed by WDFW changed about 5-7 years ago, with responsibilities being shifted from the Enforcement Program to the Wildlife Program. 2014 saw the institution of “damage tags” which must be purchased through the licensing program. Landowners are entitled to 2 free kill permits, with the requirement of reporting directly to the Conflict Specialist, and are the predominant tags issued in damage situations. Any additional permits are issued as damage permits with the requirement that the landowner, lease holder, or their designee purchase a damage tag and report their harvest through the licensing system. Conflict biologists reported 15 hunters successfully filling kill permits between July 2018 and March 2019, including a mix of mule deer and white-tailed deer. Twenty-three hunters reported hunting their damage tag, with seventeen harvesting a deer, but only nine of these were mule deer. Most hunts occurred in GMU 149 and 154 in areas where there would be very little hunting opportunity otherwise, such as in the winery and orchard areas around Walla Walla and Burbank.

Management Concerns

Although recent harvest trends show some variability, population survey results indicate the mule deer population is apparently stable in the Blue Mountains MDMZ, and the biggest management concerns are habitat alteration and effects of extreme climatic events (i.e., drought and winter conditions). The Conservation Reserve Program (CRP) acres across the zone have probably played the largest role in sustaining the mule deer population in this agriculture-dominated landscape, but CRP acreages have been declining, and incidental information indicates significant acreages will be removed from the program to be farmed in the next few years. Winter range along the breaks of the Snake and Grande Ronde Rivers is probably secure in the short-term, but expansion of wind and solar energy development, expansion of orchards and other agriculture on the south side of the Snake River, and gradual development of estates along both river valleys indicates that this range faces threats in the long-term. With the majority of mule deer habitat being in private ownership, the challenges for WDFW to protect the long-term security of mule deer in SE Washington are difficult. Supporting the CRP program in the Farm Bill and pursuing other conservation opportunities, such as conservation easements and habitat restoration, are a few of the actions WDFW can undertake to maintain habitat for mule deer across the District.

Management Conclusions

Mule deer populations in the Blue Mountains MDMZ are currently at management objective based on the 10-year mean for post-hunt buck:doe ratio, and the 2018 ratio improved over recent lows in ratios from the previous 2 years. Fawn:doe ratios, while highly variable throughout the different habitats of the District, remain within the range that supports a stable to increasing population, assuming good over-winter fawn survival from the time of surveys in December until spring green-up and average adult doe survival within the population. General season antlerless opportunity is fairly limited, and since population abundance is most sensitive to doe survival, managing antlerless permits is one of the few tools available to influence population changes. Available population survey and harvest data indicate stable populations where habitat availability and quality allow.

Columbia Plateau Mule Deer Management Zone

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Introduction

The Columbia Plateau MDMZ is located in central-eastern Washington and consists of 21 GMUs (127, 130, 133, 136, 139, 142, 248, 254, 260, 262, 266, 269, 272, 278, 284, 290, 371, 372, 373, 379, and 381; Figure 1).

This MDMZ is dominated by a mix of uncultivated shrub and grassland, and agriculture. Crops consist of a mixture of dryland and irrigated farming. Dryland crops are predominantly wheat while irrigated crops are much more diverse; including crops commonly foraged upon by mule deer such as orchards, wheat, alfalfa, and corn.

This MDMZ encompasses about 16,500 square miles and approximately 3,000 (18%) are in state and federal ownership, much of which is open to public hunting.

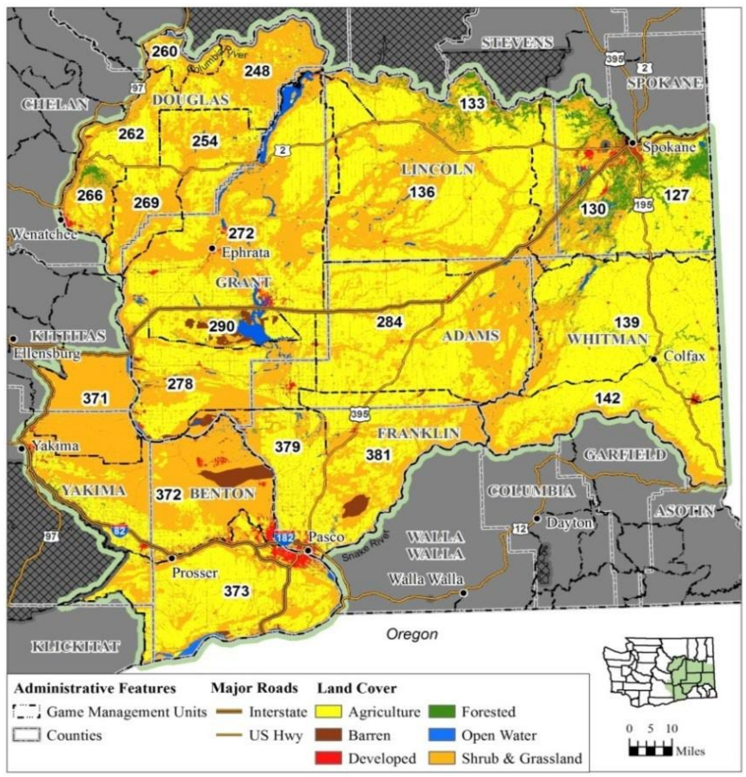

Figure 1. GMUs and generalized land cover types within the Columbia Basin MDMZ.

Management Guidelines and Objectives

The Department's objective within this MDMZ is to maintain a stable population, and to evaluate its status based on abundance surveys and harvest trend data. Additional management objectives include managing for a post-hunt population with a sex ratio of 15-19 bucks per 100 does. Quality Deer hunts in the Desert Subarea (GMU 290) are the exception, where post-hunt population management objectives are for a sex ratio of 30 bucks per 100 does via limited-entry drawing permit opportunities.

Population Surveys

Mule deer are present throughout most of the Columbia Plateau MDMZ at varying densities. Highest densities are seasonally associated with cropland with adjacent shrub-steppe or riparian habitat. Lowest densities are associated within large monotypic blocks of either agricultural crops or uncultivated ground. While no estimates of mule deer abundance exist for the entire zone, estimates are available for portions of this MDMZ where higher densities occur (Figure 2). These subherds loosely represent expected population segments within this MDMZ.

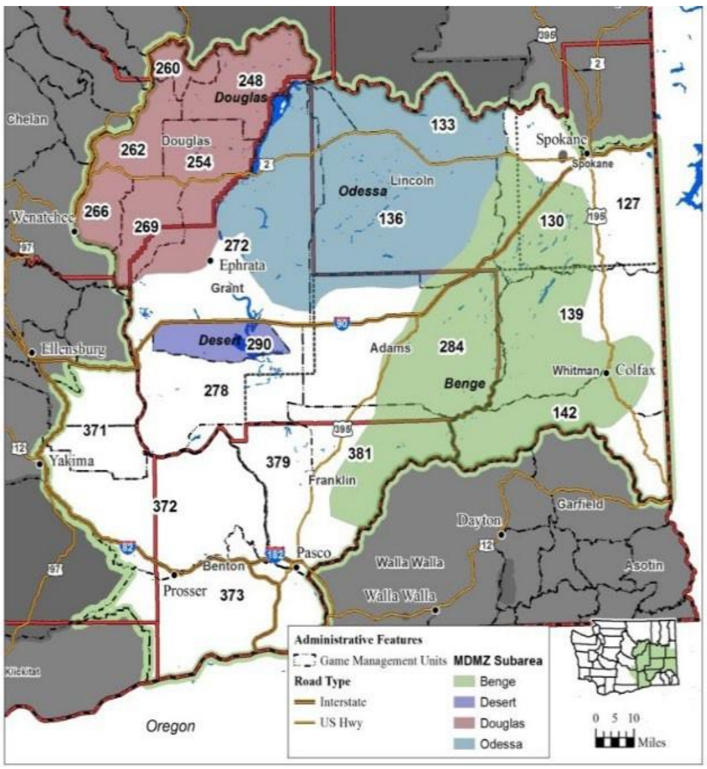

Figure 2. Subherd area boundaries for post-hunt aerial mule deer population surveys in the Columbia Plateau MDMZ.

Odessa Subherd

Odessa Subherd population estimates from aerial sightability surveys conducted from 2012-2014 resulted in population estimates ranging from 10,980 to 13,582 (Figure 3). Buck to doe ratios based on annual ground surveys between 2010 and 2018 have been above management objectives ever year except 2016, but the majority of bucks observed are yearlings (Figure 4). The decline in buck to doe ratios observed in 2016 is likely due to low recruitment of fawns from 2015 that was associated with drought conditions. The post-season buck population is highly dependent on yearlings. Fawn to doe ratios based on ground surveys have been above 60 fawns per 100 does, except in 2010 and 2015 (Figure 4).

The low fawn to doe ratio in 2015 was probably due to the 2015 drought reducing fawn survival. The lower than average fawn ratio in 2010 could have been a lingering effect of the two back-to-back hard winters of 2007-2008 and 2008-2009. It also could simply be a bi-product of being the first-year post-season ground surveys were conducted in this sub-herd.

Benge Subherd

Benge Subherd population estimates from aerial sightability surveys conducted from 2009-2011 and 2015 have ranged from 11,990 to 13,589 (Figure 5). Estimates of buck to doe ratios based on ground surveys have been above management objectives every year except 2016. However, similar to the Odessa Subherd, the majority of bucks observed were yearlings (Figure 6). The decline in the buck to doe ratio estimates observed in 2016 was likely due in part to decreased fawn survival in 2015, presumably associated with drought conditions. Fawn to doe ratio estimates based on ground surveys have remained relatively stable with a 10-yr average of 63 fawns per 100 does (range = 56– 74; Figure 6).

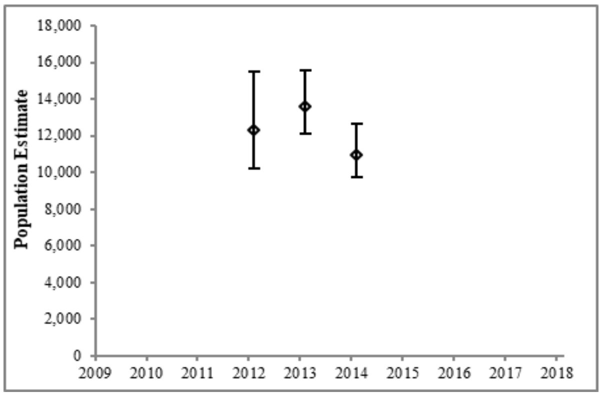

Figure 3. Abundance estimates and 90% confidence intervals from aerial mule deer surveys of the Odessa Subherd in the Columbia Plateau MDMZ, 2009-2018.

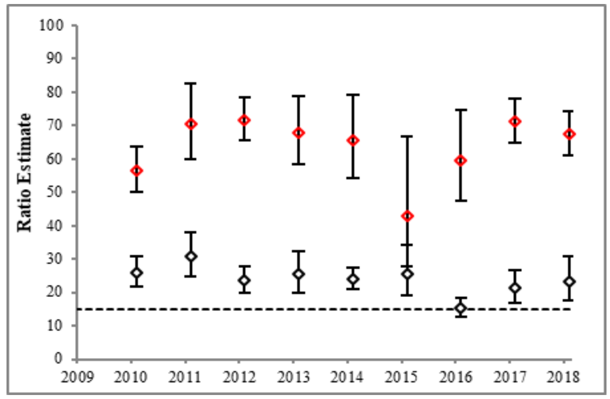

Figure 4. Fawn:doe (red) and buck:doe (black) ratio estimates and 90% confidence intervals from ground-based surveys of the Odessa Subherd in the Columbia Plateau MDMZ, 2009-2018.

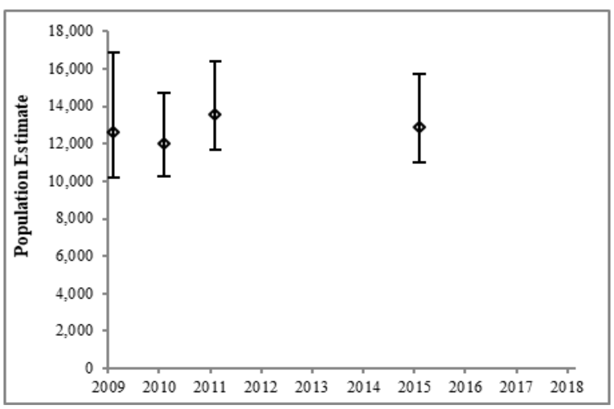

Figure 5. Abundance estimates and 90% confidence intervals from aerial mule deer surveys of the Benge Subherd in the Columbia Plateau MDMZ, 2009 - 2018.

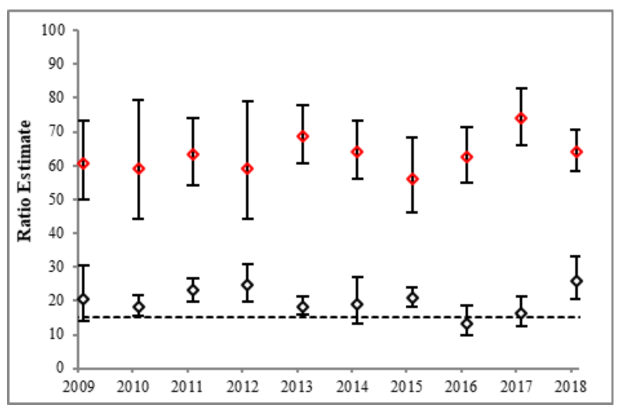

Figure 6. Fawn:doe (red) and buck:doe (black) ratio estimates and 90% confidence intervals from ground-based surveys of the Benge Subherd in the Columbia Plateau MDMZ, 2009 - 2018.

Desert Unit (GMU 290)

Desert Unit (GMU 290) buck to doe ratio estimates have been at, or above management objectives since 2006 (range = 30 - 55 bucks per 100 does; Figure 7), except in 2017 when the estimate decreased to 24. Fawn to doe ratios have been low relative to other populations within the zone (range = 29 - 58 fawns per 100 does; Figure 8). Aerial surveys were not conducted in 2018.

Douglas Subherd

Douglas Subherd buck to doe ratio estimates have been at, or above, management objectives since 2008 (average = 22:100; Figure 10). The majority of bucks classified during these surveys are in the juvenile age class because most legal bucks are harvested each year due to open cover and high road densities. In areas where landowners restrict access to large expanses of habitat, numbers of older age-class bucks are more abundant. Fawn to doe ratio estimates have been stable over that same period (average = 60:100; Figure 10). Post-hunt ratios are estimated from annual ground-based composition surveys conducted along established routes within the subherd. The first comprehensive post-hunt aerial survey of mule deer in the Douglas Subherd was conducted in 2017 and resulted in a population estimate of 12,860 mule deer (90% CI = 10,299-16,735). A second year of aerial abundance surveys estimated 15,254 deer in 2018 (90% CI=12,145-19,975). Ground surveys will continue to generate annual post-hunt estimates for buck to doe and fawn to doe ratios, with surveys for abundance estimates planned to occur on 3-5 year intervals.

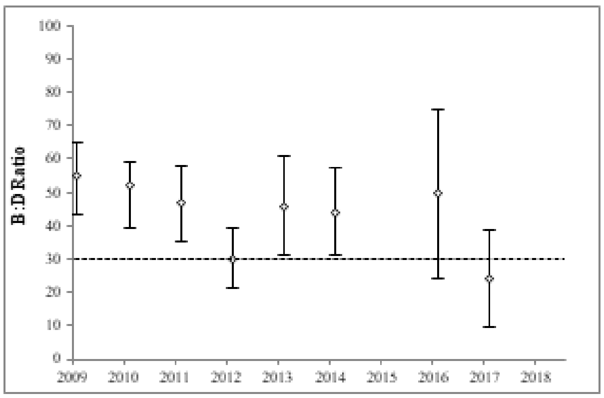

Figure 7. Buck:doe ratio estimates and 90% confidence intervals from aerial mule deer surveys of the Desert Unit in the Columbia Plateau MDMZ, 2009 - 2018.

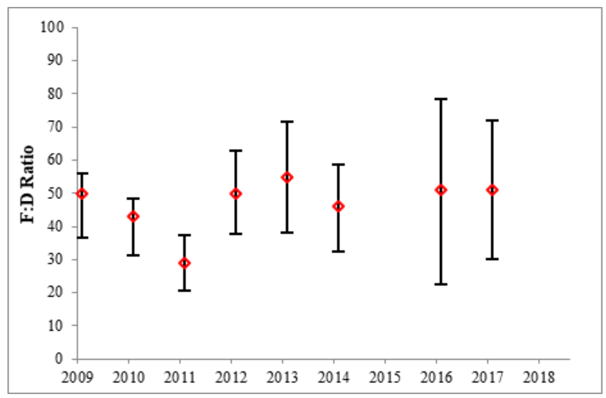

Figure 8. Fawn:doe ratio estimates and 90% confidence intervals from aerial mule deer surveys of the Desert Unit in the Columbia Plateau MDMZ, 2009 - 2018.

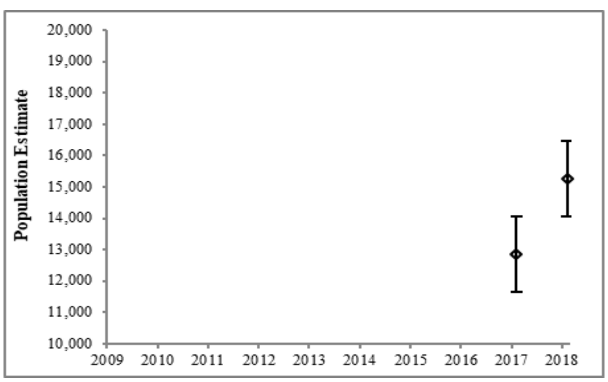

Figure 9. Abundance estimates and 90% confidence intervals from aerial mule deer surveys of the Douglas Subherd in the Columbia Plateau MDMZ, 2009 - 2018.

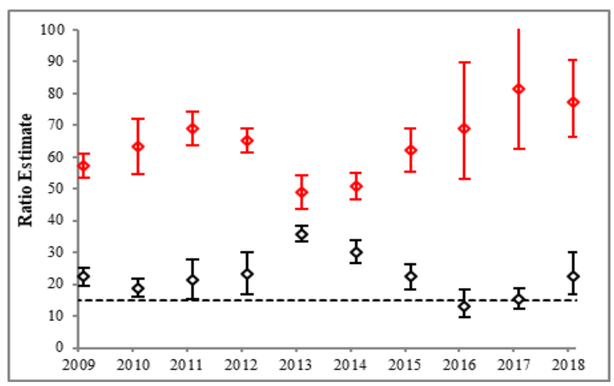

Figure 10. Fawn:doe (red) and buck:doe (black) ratio estimates and 90% confidence intervals from ground-based surveys of the Douglas Subherd in the Columbia Plateau MDMZ, 2009-2018.

Hunting Seasons and Recreational Harvest

More mule deer are harvested in the Columbia Plateau MDMZ than in any other zone and harvest has been stable to increasing over the past decade with the exception of 2016 and 2017 (Figure 11a). The decline in 2016 harvest was likely due to poor fawn recruitment in 2015 associated with drought conditions. However, there were fewer hunters, which may have resulted in fewer deer being harvested. Measures of hunter effort in the zone have generally been stable during the past 10-years years (Figure 11b). Estimates of hunter effort (i.e., hunter days; Figure 11b) in this zone are not mule deer specific and include days spent hunting white-tailed deer. Because harvest data are specific to mule deer, kills/day estimates are consequently biased.

a) b)

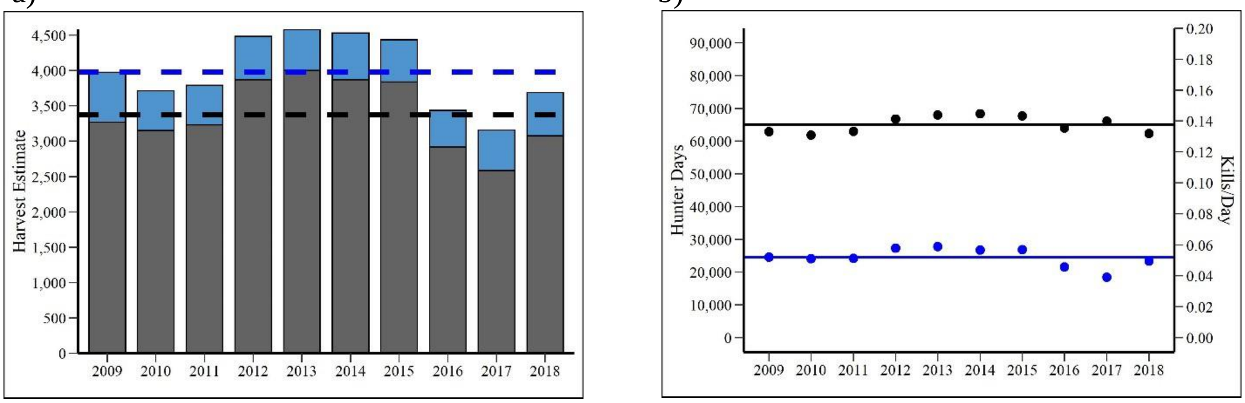

Figure 11. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray) and General + Permit State Harvest (blue); and (b) general season estimates and 10-yr mean for hunter days (black) and kills/day (blue) in the Columbia Plateau MDMZ, 2009–2018.

Survival and Mortality

Field studies conducted in the eastern portion of this zone between 2000 and 2008 indicated annual survival ($\hat{s}$ = 0.92, 95% CI = 0.91 – 0.93), pregnancy ($\hat{p}$ = 0.96, 90% CI = 0.91-1.0), and fetal rates ($\hat{f}$ = 1.44, 90% CI = 1.20-1.68) of adult female mule deer were sufficient to maintain stable populations (WDFW 2016). Cause-specific mortality for radio-marked juvenile mule deer (30 marked as neonates, 35 marked at 6 months of age) indicated legal hunting and coyotes were the most frequent sources of mortality (n = 28). Juvenile survival rates during the first summer ($\hat{s}$ = 0.52) and the first winter (fawns transitioning into the yearling age class; $\hat{s}$ = 0.90) were sufficient to maintain stable populations (Johnstone-Yellin et al. 2009, WDFW 2016).

While not observed during the field studies, other sources of mule deer mortality likely include predation (not only coyotes), collisions with vehicles, perishing in irrigation canals, and poaching. Predator species living within this zone include cougars, bobcats, black bears, coyotes, golden eagles, and domestic dogs. Availability of suitable habitat, disease events and other factors will influence survival, pregnancy rates, and fetal rates. Therefore, results from former studies are not necessarily indicative of the status of the current population.

Habitat

Loss of important habitat, particularly shrub-steppe, riparian, and wet meadow habitat, is the most important issue facing wildlife managers in the Columbia Plateau MDMZ. Land conversion is the most obvious source of habitat loss, but in this zone, wildfires have become more frequent and more intense in recent years. These fires often result in a rapid invasion of exotic plant species such as cheatgrass, which perpetuates more fire. Restoration of native vegetation requires intensive, expensive, long-term effort to be successful. In some areas of the zone where crop fields have been enrolled in the Conservation Reserve Program (CRP), the increase in associated cover and introduction of beneficial plant species may partially mitigate losses of shrub-steppe, especially important during fawning season.

Human-Wildlife Interaction

Mule deer in the Columbia Plateau MDMZ are largely migratory and often stage in large numbers on the way to, and at, the wintering grounds along the Snake River breaks and the Wilson Creek area. These large congregations are cause for concern from wheat farmers, although research suggests crop depredation by large ungulates does not influence grain yield, provided it occurs before the joint stage when plants begin to invest in their reproductive phase (Austin and Urness 1995, Dunphy et al. 1982). However, grazing on alfalfa and hay fields does have the potential to reduce crop production (Austin et al. 1998). Currently, five Deer Areas with additional permit opportunities exist within this zone to address impacts associated with these congregations (Figure 12).

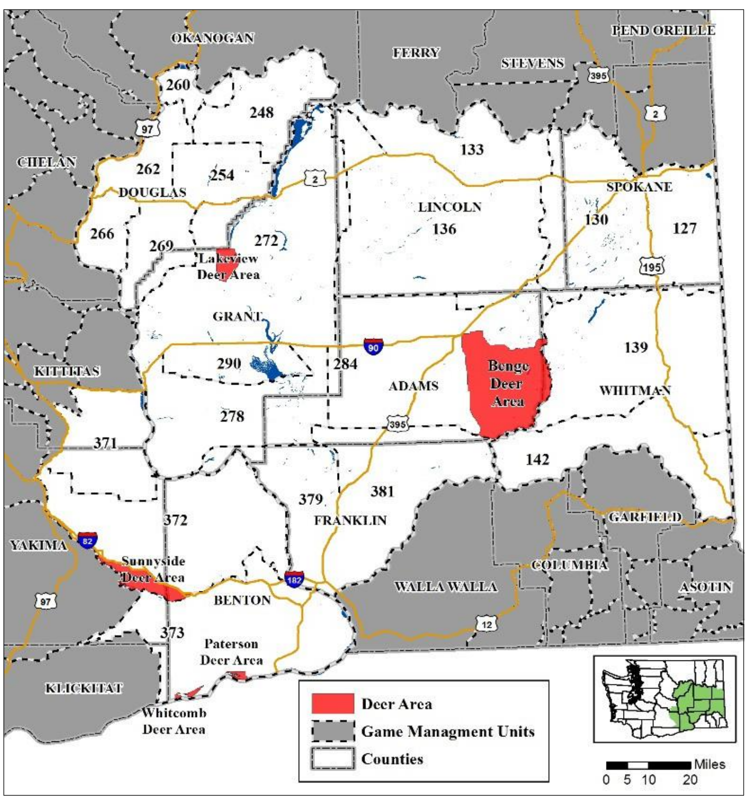

Figure 12. Deer Areas within the Columbia Plateau MDMZ, 2017.

Nuisance damage in suburban areas can also be a problem, and WDFW provides additional antlerless hunting opportunities to address this issue. The WDFW Wildlife Conflict Section staff work with producers to provide technical assistance in both lethal and non- lethal control of deer on agricultural lands, including orchards and vineyards with high value crops favored by deer.

Management Concerns

As previously discussed, habitat loss and habitat degradation are management concerns in this area. While expansion of agricultural crops is currently at a standstill throughout much of this zone, habitat conversion through urban sprawl and small ranch development is slowly taking a toll. Loss of lands enrolled in CRP programs due to Federal budgets and county caps could drastically reduce available habitat in this zone. Additionally, recent changes to the Federal Farm Bill may allow for cattle grazing and harvest of CRP lands. Those changes there could negatively affect wildlife by reducing forage and cover, as well as having other impacts from associated infrastructure developments. Impacts from wildfires vary depending upon the type of habitat burned, overall size of the area burned, season of burn, and intensity of the burn. Short-term impacts may include reduced habitat suitability, which is particularly damaging during the summer fawning season and/or when precipitation fails to initiate fall green-up and animals are unable to increase nutritional reserves needed to meet the demand of a harsh winter. Long-term benefits of fire within the Columbia Plateau landscape depend on fire history and prevalence of invasive vegetation. Areas with older shrub-steppe habitat and good species diversity are limited and declining annually, due to fires and housing development. High-value shrub-steppe habitat can take over 50 years to develop and combating encroachment by invasive species is a difficult and expensive battle once intact habitat burns.

Management Conclusions

Mule deer populations in the Columbia Plateau MDMZ are currently at management objective based on buck to doe ratio estimates. Demographic and survey data indicate stable populations between years. Zone-wide harvest has been stable over the long term, but low the past three years.

Literature Cited

Austin, D. D., P. J. Urness, and D. Duersch. 1998. Alfalfa hay crop loss due to mule deer depredation. Journal of Range Management 51:29-31.

Austin, D. D. and P. J. Urness. 1995. Wild Ungulate depredation on winter wheat: effects on grain yield. Great Plains Wildlife Damage Control Workshop Proceedings. Paper 422:51-55.

Dunphy, D. J., M. E. McDaniel, and E. C. Holt. 1982. Effect of forage utilization on wheat grain yield. Crop Science 22:106-109.

Johnstone-Yellin, T. L., L. A. Shipley, W. L. Myers, and H. S. Robinson. 2009. To twin or not to twin? Trade-offs in litter size and fawn survival in mule deer. Journal of Mammalogy 90:453–460.

Washington Department of Fish and Wildlife. 2016. Washington State mule deer management plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA. 144 p.

East Columbia Gorge Mule Deer Management Zone

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Introduction

The East Columbia Gorge Mule Deer Management Zone (MDMZ), located in south central Washington, is the smallest of the seven mule deer management zones and consists of two GMUs: 382 and 388 (Figure 1).

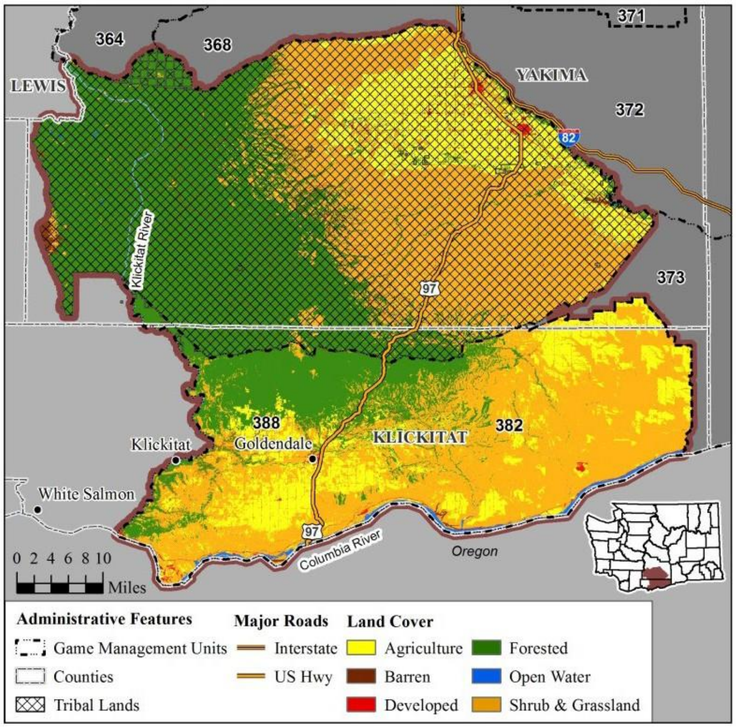


Figure 1. GMUs and generalized land cover types within the East Columbia Gorge MDMZ.

Management Guidelines and Objectives

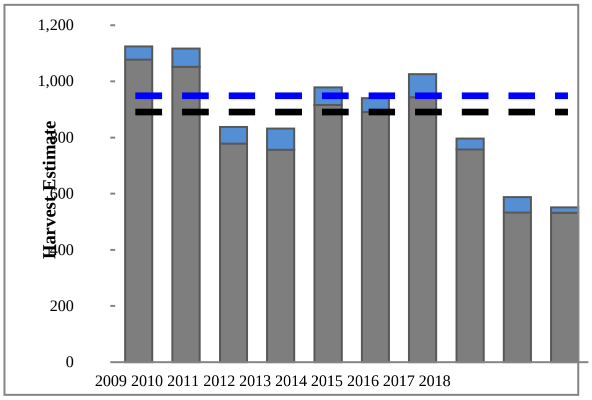
The Department's objective within this MDMZ is to maintain a stable population based on field surveys and harvest estimates. Additional management objectives include managing for a post-hunt population with a sex ratio of 15-19 bucks:100 does (WDFW 2014).

Population Surveys

Mule deer are present throughout the East Columbia Gorge MDMZ with the highest densities observed January through April throughout the low-elevation winter ranges. Post-hunt aerial surveys conducted in December of 2018 resulted in a buck:doe ratio estimate of 14:100 (95% CI = 8–20, n = 1,220), which is low, but very close to the management objective. The post- hunt fawn:doe ratio estimate for 2018 was 62:100 (95% CI = 45–79, n = 1,220), which is close to the 64 fawns:100 does found in 2017 and up from surveys in 2015 and 2016 which found ratios of 56:100 and 58:100, respectively.

Hunting Seasons and Recreational Harvest

Estimates indicate a decline in harvest (Figure 2a) that likely reflects, in part, lower hunter numbers and related hunter effort (Figure 2b), fewer antlerless permits offered, as well as population declines within the zone in recent years. Estimates of kills/day were up slightly in 2018 after seeing declines in 2016 and 2017 (Figure 2b).



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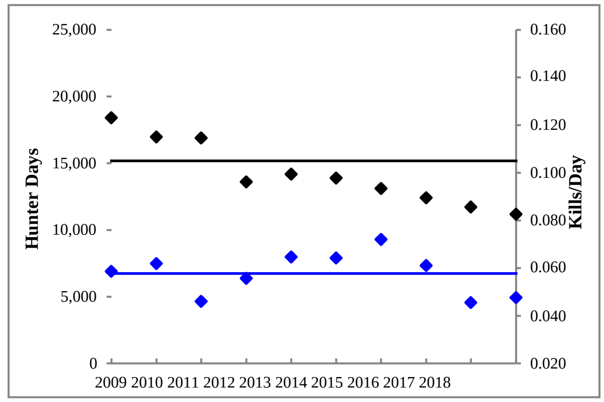

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Figure 2. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray) and General + Permit State Harvest (blue); and (b) general season estimates and 10-yr mean for hunter days (black) and kills/day (blue); in the East Columbia Gorge MDMZ, 2009–2018.

Survival and Mortality

There are no current data on annual survival rates of mule deer in the East Columbia Gorge MDMZ. In addition to legal hunting, common mortality sources include disease, predation, and deer-vehicle collisions. Lice infestations and hair loss syndrome have been documented in mule deer (Bernatowicz et al. 2011) and likely contribute to the decline in mule deer numbers. Common predator species include cougar, bobcat, black bear, and coyote.

The winter of 2016-17 was very severe with persistent snow down to river level from December through February, making forage unavailable in key wintering habitat. As a result, both population and harvest estimates have dropped in the past two years. The two following winters were mild to average, except for the late winter/early spring of 2019, which had several large snowfall events and persistent cold temperatures into April. Productivity surveys in spring of 2019 showed a fawn:adult ratio of 60:100, which is above the 10-year average of 55:100. Staff also did not receive reports of substantial winterkill as they did in 2016-17, indicating the late snowfall likely did not significantly affect adult or fawn survival. The annual post-hunt aerial surveys scheduled for December 2019 will continue to monitor the population as it hopefully recovers from the severe winter of 2016-17.

In the summer of 2017, an outbreak of Adenovirus Hemorrhagic Disease (AHD) was confirmed in the area just east of Goldendale in both GMUs 382 and 388. High rates of fawn mortality were observed, which is typical with this disease. This type of AHD is specific to deer and has occurred in other states, including Oregon and California. Given the relative commonness of AHD, the disease has probably been present in Washington before, but was not detected. The last report of AHD in the Goldendale area was in September 2017 and there were no confirmed reports of AHD in 2018 or 2019.

Habitat

The East Columbia Gorge MDMZ has experienced extensive alternative energy development and agricultural land conversion in recent years. Electricity generated by wind power currently is one of the fastest growing alternative energy sources in the region with large wind power sites already in operation along the Columbia River. Despite being thought of as a "green" energy source, wind farms reduce and fragment critical habitat (Hebblewhite 2008, Fargione et al. 2012), especially in the winter range of mule deer in the East Columbia Gorge MDMZ. In addition, several solar farm proposals in the area are in various stages of permitting. These operations typically include tall fencing and vegetation damage, resulting in complete habitat loss (Lutz et al. 2011). More direct effects on the population have occurred in the form of habitat loss from agricultural conversion and associated roadways necessary to access such development, as well as increased mortality from vehicle collisions.

Human-Wildlife Interaction

Agricultural damage to crops such as hay, alfalfa, wheat, berries, and grapes occurs at low levels in the East Columbia Gorge MDMZ. 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. Wildlife Conflict Specialists and landowners use a variety of non-lethal means to discourage deer including electrified fladry fencing, noisemakers (e.g., bird bangers, critter gitters, and propane cannons), hazing and herding, scarecrow-like electronic devices, and odor-based repellents such as Plantskyyd. One DPCA was issued in 2018-19 related to mule deer in the East Columbia Gorge MDMZ. No kill permits were issued or damage hunters deployed as a result of this DPCA. 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.

Management Concerns

Deer hairloss syndrome was observed in Klickitat County for the first time in 2000. Hairloss was first documented in GMU 382 in the spring of 2006. Approximately 6.2% of deer observed during road-based surveys conducted in April 2019 in and around the Klickitat Wildlife Area had noticeable signs of the syndrome, which is slightly below the average observed since 2008 (7.2%). Late 1990s declines in harvest, increases in buck mortality rates, and reduced productivity all roughly coincide with the onset of the hairloss syndrome. We will continue to monitor for this disease during spring surveys.

Habitat loss is the greatest concern for mule deer in the East Columbia Gorge MDMZ. Increased land conversion, especially into vineyards, and wind and solar farms have the potential to negatively affect this herd. Not only do developments reduce the amount of available habitat, but their associated roads and fencing increase the risk of deer-vehicle collisions and inhibit movement across the landscape. Many of the deer in this zone are migratory and spend the winter in lower elevations, typically preferring habitat with a strong oak (Quercus garryana) component (McCorquodale 1996). Increased human activity and habitat conversion in lower elevation wintering areas can cause these deer to unnecessarily expend energy during the winter months when resources are limited, resulting in lower survival and reproduction rates.

Management Conclusions

Mule deer populations in the East Columbia Gorge MDMZ are currently slightly below the buck:doe management objective. Both abundance and harvest estimates were low in 2017 and 2018 when compared to previous seasons, indicating a decrease in the population. After the 2017 and 2018 hunting seasons, managers removed most anterless special permits, reduced the number of remaining anterless permits, and reduced the number of buck special permits to allow the population to recover. Annual survey efforts and the data collected from hunter reporting will allow managers to continue monitoring the population and determine future management needs.

Literature Cited

Bernatowicz, J. A., K. Mansfield, J. W. Mertins, and W. Moore. 2011. Hair-loss syndrome in deer in south central Washington. S. M. McCorquodale, editor. Proceedings of the 8th Western States and Provinces Deer and Elk Workshop – 2009. Washington Department of Fish and Wildlife. Olympia, WA.

Fargione, J., Kiesecker, J., Jan Slaats, M., and Olimb, S. 2012. Wind and wildlife in the Northern Great Plains: Identifying low-impact areas for wind development. *PLOS ONE*, 7(7): e41468.

Hebblewhite, M. 2008. A literature review of the effects of energy development on ungulates: implications for central and eastern Montana.

Lutz, D. W., J. R. Heffelfinger, S. A. Tessmann, R. S. Gamo, and S. Siegel. 2011. Energy Development Guidelines for Mule Deer. Mule Deer Working Group, Western Association of Fish and Wildlife Agencies, USA.

McCorquodale, S. M. 1996. Ecology and co-management of black-tailed deer in the Klickitat Basin of Washington. Yakama Nation Wildlife Program Report. Yakima, WA. 118p.

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

East Slope Cascades Mule Deer Management Zone

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Introduction

The East Slope Cascades MDMZ, home to Washington's major migratory mule deer populations, spans three wildlife districts (districts 6, 7, and the northern portion of 8) in north-central Washington and is comprised of 22 GMUs (203, 209, 215, 218, 224, 231, 233, 239, 242, 243, 244, 245, 246, 247, 249, 250, 251, 328, 329, 330, 334, and 335; Figure 1).

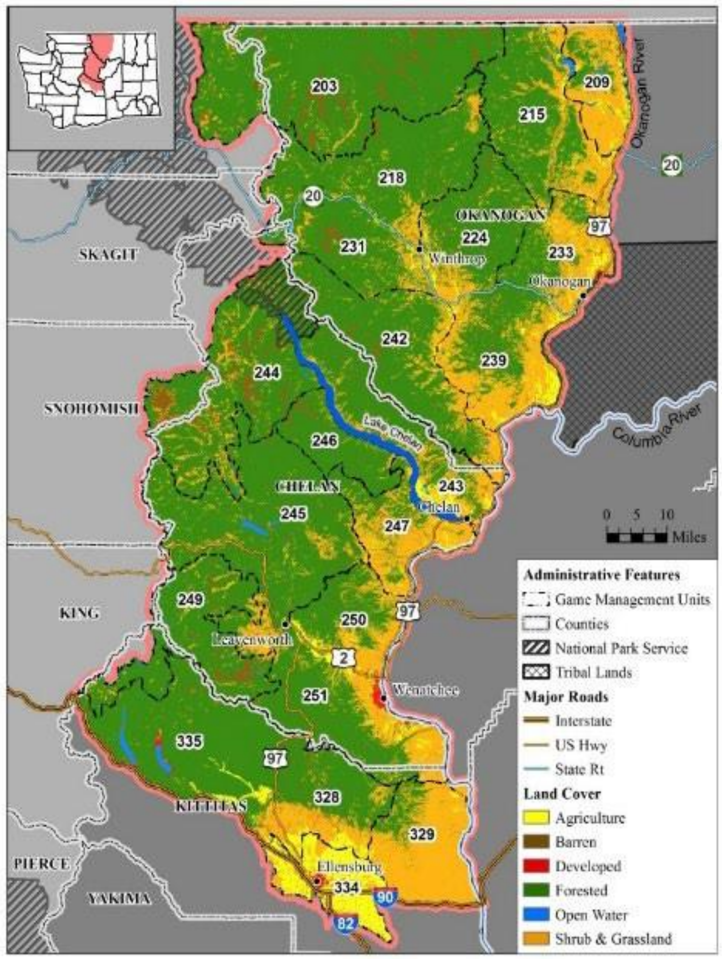


Figure 1. GMUs and generalized land cover types within the East Slope Cascades MDMZ.

Management Guidelines and Objectives

The Department's objective within this MDMZ is to maintain stable populations based on field surveys and harvest estimates and manage for a post-hunt buck:doe ratio of 15-19 bucks:100 does in the southern and northern portions, and a minimum of 25 bucks:100 does in the central portion.

Population Surveys

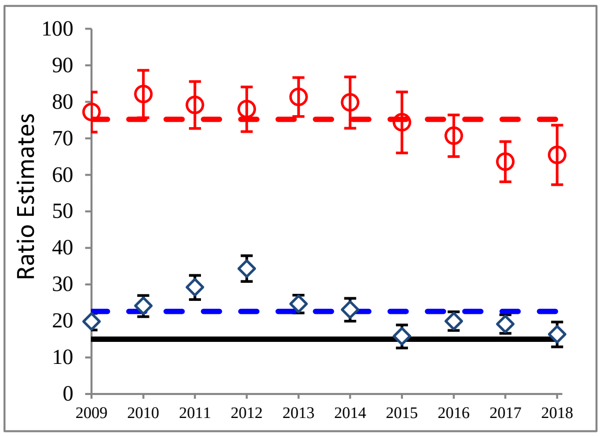
Mule deer are present throughout the East Slope Cascades MDMZ with the highest densities observed during January through March on the low elevation traditional winter ranges. Populations within the zone are comprised of 4 general subherds, from north to south they are the Methow and Okanogan (western Okanogan County), Chelan (Chelan County), and Kittitas (Kittitas County north of I-90) subherds. The last zone-wide post-hunt aerial sightability surveys indicated approximately 47,000 mule deer resided within the East Slope Cascades MDMZ at that time (WDFW 2013).

Methow and Okanogan Subherds

Post-hunt aerial surveys were conducted in early December 2018 for the Methow subherd (District 6) produced a raw buck:doe ratio estimate of 16:100 (95% CI = 13-20, *n* =734), equaling the low over the last 10 years. The mean buck:doe ratio estimate from aerial surveys conducted between 2009 and 2018 was 23:100 (range = 16 - 34).

The post-hunt fawn:doe ratio (an index of productivity) in 2018 was 65:100 (95% CI = 57-74, *n* = 1,044; Figure 2a). This is noticeably below the 10-year average of 75:100 (range = 64 – 82).

In 2019, ground counts produced a spring fawn:adult ratio (Figure 2b) of 35:100 (95% CI=31-39, *n* = 1,388), slightly above the 10-yr average of 33. These data yielded a rough over-winter fawn mortality estimate of 43%, significantly below the 10-year average of 52%, a reflection of last year's mild winter and improving post-fire winter range forage conditions.



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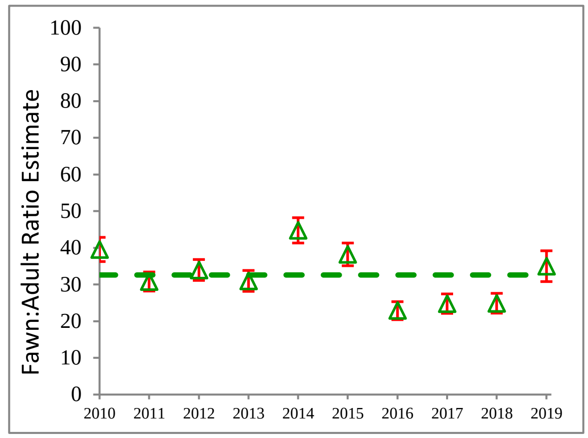

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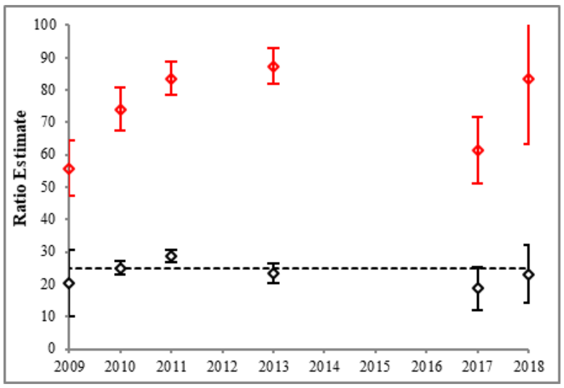
Figure 2. Post-hunt (a) buck:doe ratio estimates (black) and fawn:doe ratio estimates (red), and buck:doe ratio management objective (dashed line), 2009 - 2018; and (b) spring fawn:adult ratios with 10-year average (dashed line), 2010 - 2019; for mule deer in the northern subherds of the East Slope Cascades MDMZ.

Buck:doe ratios for the northern subherds have been meeting or exceeding the management objective of 15:100 does (Figures 2a). A combination of rugged topography and limited road access in many GMUs allows for high escapement and results in a higher proportion of older age-class bucks in the population. Fawn recruitment varies year to year, largely fluctuating in response to winter conditions. High quality summer range has traditionally led to high fawn production; however, late fall fawn:doe ratios are down somewhat in recent years likely a result of persistent drought conditions (Figures 2a and 2b). Survey efforts have largely focused on the Methow subherd during the last 4 years due to concurrent research investigating survival rates for that subherd. However, ratio data have also been collected for the Okanogan subherd every few years and trends seen for mule deer in the Methow subherd likely track with those of the Okanogan subherd.

Chelan Subherd

Poor winter flying conditions in the central portion of the zone (District 7) have limited yearly post-hunt aerial surveys for population estimates (including in 2017). Spring aerial surveys resulted in population estimates of 14,870 mule deer (90% CI = 12,085-19,679) in 2016 and 11,061 mule deer (90% CI = 9,317-13,865) in 2017. These estimates are comparable to post-hunt population estimates from 2010 and 2011 (Figure 3b). Cumulative impacts of severe drought and large wildfires in 2015, combined with a severe winter in 2016/17 likely contributed to a decline in this population, as was detected in spring 2017 (Figure 3b).

Management of the Chelan subherd is conservative with a post hunt buck ratio objective of 25+ bucks per 100 does. Since 2009, estimates of post-hunt buck:doe ratios have largely been sustained at this objective. The combination of high buck harvests in 2015 and 2016, along with the effects of the 2016-17 winter appear to be responsible for a decline in the buck:doe ratio in 2017. The 2018 post-hunt estimated buck:doe ratios were 23.1:100 (90% CI = 14.1 – 32.2), which is up from the previous estimate in 2017 of 18.7:100 (90% CI = 12.0 – 25.4; Figure 3a). Fawn:doe ratios also increased from 2017 to 2018 with the 2017 post-hunt fawn:doe ratio estimated at 61.5:100 (90% CI =51.1 – 71.84) and the 2018 post-hunt fawn:doe ratio estimate of 83.4 (90% CI = 63.4 – 103.4; Figure 3a).



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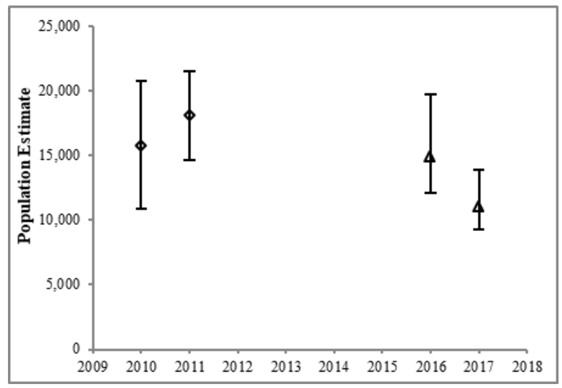

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Figure 3. Estimates of (a) post-hunt buck:doe (black) and fawn:doe ratios (red) with 90% confidence intervals, and the buck:doe ratio management objective (dashed line) and, (b) abundance estimates with 90% confidence intervals from aerial surveys conducted post-hunt in fall 2010 and 2011 (diamonds) and spring in 2016 and 2017 (triangles), for the Chelan subherd in the East Slope Cascades MDMZ between 2009 and 2018.

Kittitas Subherd

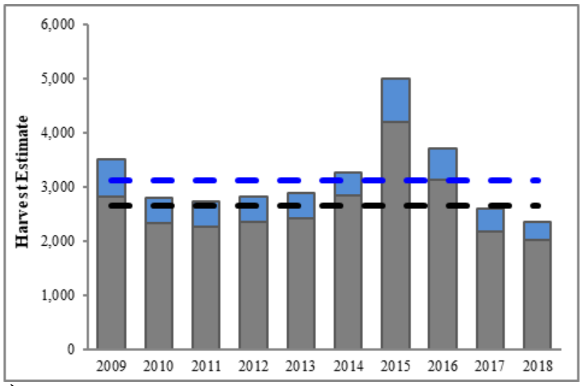
In 2016, spring population surveys were conducted in the southern portion of the zone (Kittitas Subherd; District 8). The estimate was 3,718 deer (90% CI = 3,307-4,494). The southern population was down 40% from 2003 and 10% from the last survey in 2013. No surveys have been conducted since 2016, but harvest indicates little change in the population.

Hunting Seasons and Recreational Harvest

Mule deer harvest in much of the East Slope Cascades MDMZ is greatly influenced by the interaction of modern firearm general season dates and weather conditions during this season. A later than average season ending date and significant early high-country snow combined to produce a harvest spike in 2015. For the last two years, the calendar cycle has produced slightly earlier general season ending dates and early fall weather conditions have been relatively mild.

Conservative harvest of antlerless mule deer is generally designed to maintain population stability while still providing some recreational opportunity. Liberal harvest of antlerless mule deer is used at times to limit herd growth, or reduce deer numbers in damage areas, or for responses to dramatic changes in carrying capacity such as those associated with large wildfires.

Overall harvest estimates from the last three years indicate a decreasing trend following the harvest increase in 2015, with the total in 2018 falling approximately 20% below the 10-year average (Figure 4a). Hunter days increased in 2016 and 2017, but in 2018 estimated hunter days declined again to approximately the 10-year average (Figure 4b).



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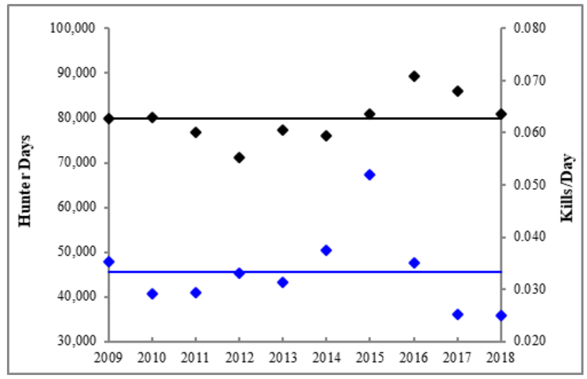


b)

Figure 4. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray) and General + Permit State Harvest (blue); and (b) general season estimates and 10-yr mean for hunter days (black) and kills/day (blue); in the East Slope Cascades MDMZ, 2009–2018.

Survival and Mortality

Data from past research in the central portion of the East Slope Cascades MDMZ on pregnancy ($p\hat{p} = 0.95$) and fetal rates ($f\hat{f} = 1.66$), coupled with a high annual adult doe survival rate ($s\hat{s} = 0.92$, $n = 50$) indicate sufficient recruitment to support a stable to increasing population in this portion of the zone (WDFW 2016). Research investigating survival of adult mule deer in the Methow subherd is ongoing and should provide important insights into population status in coming years.

Habitat

The productive, high mountain habitats in this zone make the East Slope Cascades MDMZ extremely important to mule deer. These optimal habitat conditions provide nutritious forage for lactating does and contribute to high fawn survival and recruitment. These habitats are not limited, face little threat of direct human alteration, and are at present self-sustaining.

In recent years, however, drought conditions have arisen more frequently and become more intense, negatively impacting summer forage in the second half of the growing season, and fostering large, intense wildfires. Many models predict these warmer and drier conditions will become more common as climate change progresses.

On winter ranges, mule deer move to a small portion of the overall landscape to avoid deep snow and find forage and thermal cover. This lower elevation habitat is under greater threat of alteration and disturbance; however, 25+ years of securing conservation status for critical areas has improved the long-term outlook.

Habitat related considerations in this zone include continued development and fragmentation of low-elevation habitats, growing use and distribution of off-road vehicles, and increasing disturbance on winter ranges. This is compounded by recent landscape level fires at low elevation and increasing spread of invasive weeds, which result in a reduction of shrub vegetation communities.

Human-Wildlife Interaction

Most deer conflict is restricted to the lower elevation irrigated agriculture lands throughout the Zone. Specific Deer Areas have been established in the northern portion of this Zone with antlerless permit hunt seasons designed to target and reduce deer damage. Permit numbers within each Deer Area fluctuate with the level of reported damage incidents and are currently at minimal levels. To date, the program is operating smoothly and appears to be helpful in reducing deer damage complaints.

Damage Prevention Cooperative Agreements (DPCA) and Kill permits are also conservatively issued to reduce deer damage throughout the Zone. In 2018, WDFW Conflict Specialists issued only 20 deer (Mule or White-tailed deer) permits to address deer damage throughout the entire East Slope Cascades Mule Deer Management Zone.

Significant roadkill occurs in the northern portion of this zone along State Highways 20 and 153 in the Methow Valley and along a 12.5-mile segment of State Highway 97 in the Okanogan Valley. The Okanogan Trails Mule Deer Foundation Chapter and others are working with the WA Department of Transportation to create underpasses(s) and fencing along this segment to reduce roadkill and provide safer passage. In the central portion of the zone, State Highways 97 and 97A are the major contributors to deer vehicle collisions.

Research

A large-scale predator-prey study with a mule deer component began in the northern portion of the zone in January 2017. By the end of January 2018 biologists had radio-marked 100 mule deer does. Project staff follow up on mortalities to determine mortality source and where applicable, predation type to the extent possible. Researchers intend to redeploy the collars from deceased deer to maintain a sample size of about 100 throughout the course of the study. The radio-marked animals are also being used to develop a sightability model that will be used to generate population estimates for the East Slope Cascades MDMZ, and hopefully, will be adapted to other parts of Washington as well.

Management Concerns

Extensive loss of winter range shrub forage (primarily due to fire) is currently the major management concern in the northern three-fourths of the zone. Modest increases in antlerless harvest were implemented for a few years in the most heavily impacted GMUs. These increases in combination with two moderately tough winters appear to have met the objective of stabilizing or slightly decreasing the local population in the short-term to bring deer numbers in line with the landscape's reduced carrying capacity and avoid over-browsing of recovering winter range shrubs. Antlerless harvest levels have returned to conservative pre-fire levels. The issue of winter range shrub loss is compounded by the post-fire conversion of these communities toward invasive weeds, decreasing the capability of the landscape to support deer. These affects are most prominent on dry shallow soils on steep aspects; areas where conditions limit restoration success.

In the northern portion of the zone, recent composition counts have documented a decline in post-season fawn:doe ratios reaching a 12-year low in 2017. This occurred during a period of intense summer drought for 3 of the last 4 years, which may be a significant factor in the decline given the importance of high-quality summer range for productivity and overall deer health.

Management Conclusions

Mule deer populations in the East Slope Cascades MDMZ are currently meeting the minimum management objective in the north (15-19 bucks:100 does) and the central portion (25 bucks:100 does), and slightly lower than objective in the south, suggesting current buck harvest strategies are generally sustainable. Recent survey data indicate a decline in the overall population in the zone, supporting a reduction in antlerless harvest. A reversal of the current population trend is anticipated to the extent that: 1) winter shrub forage continues to recover, 2) winter conditions are moderate, and 3) summer moisture improves. 2019 saw improvements in all three of these variables, improving the outlook for herd growth.

Literature Cited

Washington Department of Fish and Wildlife. 2013. Game status and trend report. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA.

Washington Department of Fish and Wildlife. 2016. Washington State Mule Deer Management Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA. 144 p.

Naches Mule Deer Management Zone

JEFFREY A. BERNATOWICZ, Wildlife Biologist

Introduction

The Naches MDMZ is located in central Washington (Figure 1) and includes GMUs 336, 340, 342, 346, 352, 356, 360, 364, and 368.

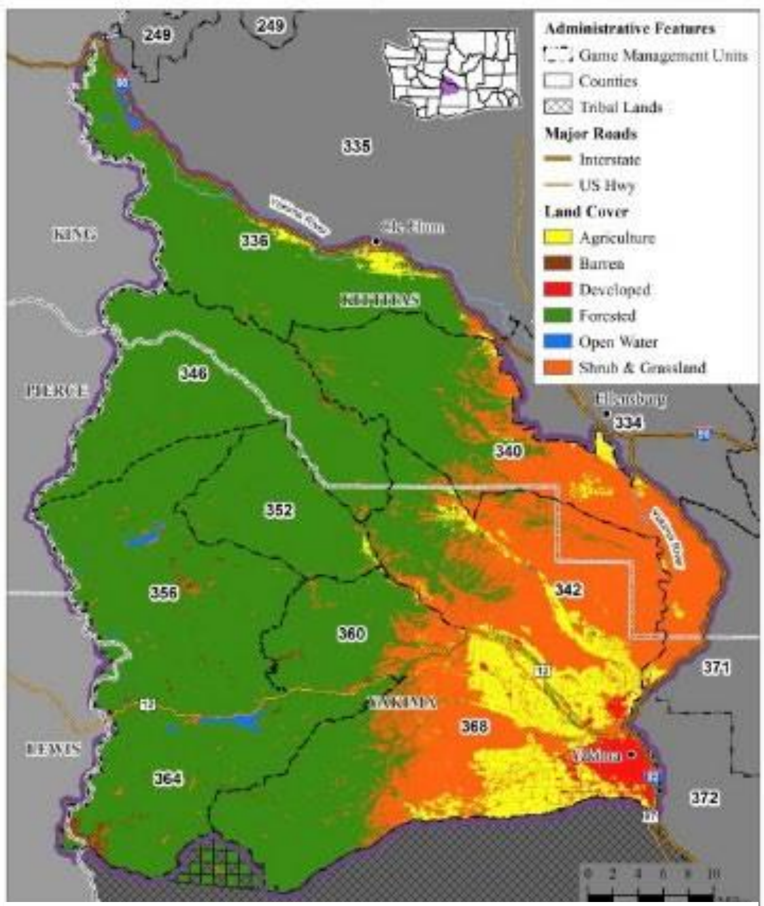


Figure 1. GMUs and generalized land cover types within the Naches MDMZ.

Management Guidelines and Objectives

The Department's objective within this MDMZ is to maintain a stable population based on field surveys and harvest estimates. Additional management objectives include managing for a post-hunt population with a sex ratio of 15-19 bucks:100 does.

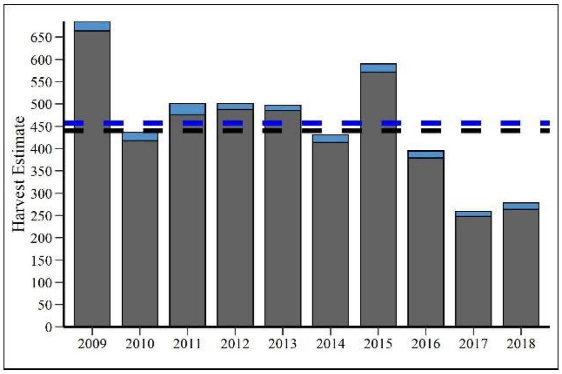
Population Surveys

Mule deer are present throughout the Naches MDMZ, with the highest densities observed March and April on low elevation winter ranges as the green-up progresses. Spring aerial surveys have been conducted in the zone since 2003 to estimate abundance. In March 2003, the population was estimated at 7,865 deer (90% CI = 7,114-9,086). Spring aerial population surveys have continued in portions of the zone most years and indicated about a 50% decline by 2007 in those portions of the zone surveyed. In 2013, the abundance estimate for the MDMZ was 4,997 (90% CI = 4,587-5,625), down 36% from the zone-wide 2003 estimate (WDFW 2013). In 2017, only the northern portion of the zone was flown. The population in the northern portion decreased about 43% from 2015 to 2017. The Muckleshoot tribe flew the northern zone in 2018 and 2019. The population rebounded slightly in 2018 and there was no change from 2018 to 2019.

Ground surveys have been conducted periodically since the early 1990's to estimate post-hunt buck:doe ratios for the zone. Surveys were attempted in December 2017, but a low sample size precluded a reliable ratio estimate.

Hunting Seasons and Recreational Harvest

State harvest trend for the past 10 years has been variable annually, but relatively stable overall (Figure 2). Neither Native American tribe that hunts the Naches MDZ officially reports harvest. The Yakama Nation season for bucks is year-round, with antlerless take allowed September through December. The Muckleshoot Indian Tribe restricts harvest to buck-only during the fall.



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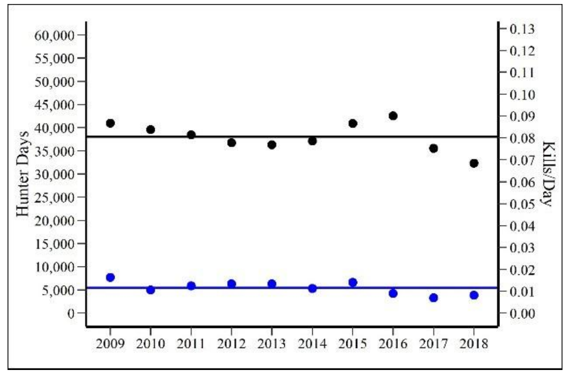

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Figure 2. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray) and General + Permit State Harvest (blue); and b) general season estimates and 10-yr mean for hunter days (black) and harvest/day (blue) in the Naches MDMZ, 2008–2017.

Survival and Mortality

Telemetry studies conducted by the Muckleshoot Indian Tribe and initiated in 2012 are ongoing and will provide managers with some zone-specific survival and movement information. Their goal is to have 100 adult does radio-collared each winter. Estimates of annual survival rates for adult female mule deer average 80% and range from 67% in years with more severe drought/winter weather to 87% in "good years". These estimates are consistent with adult female survival documented in other mule deer populations throughout the west (Bleich and Taylor 1998, Unsworth et al. 1999, Bishop et al. 2005, Hurley et al. 2011, Monteith et al. 2014). However, the survival estimates are lower than observed in the WDFW's research conducted in the Columbia Plateau, East Slope Cascades, and Okanogan Highlands MDMZs (WDFW 2016). Predation by cougars has accounted for the highest proportion of the radio-marked deer mortalities in this MDMZ (≈40%). The second and third highest proportions of total mortality were attributed to malnutrition and human-caused mortality, at 26% and 16% of total mortalities, respectively.

Since 2004, some deer in this zone were affected by hair-loss syndrome, a condition caused by an exotic louse. The mule deer population declined in the mid-2000s in this MDMZ, and the contributing factors are suspected to have been hair-loss syndrome and exacerbating winter mortality (Bernatowicz et al. 2011). Another suspected, but unconfirmed, pathogen may have been adenovirus. The population has not rebounded to recent historic levels noted before 2004.

Habitat

Deer radioed in the northern portion of the winter range disperse through much of the MDMZ, but densities are highest in GMU's 340 and 342. Harvest data match radio-marked deer distribution. There are currently no measures of habitat quality for this deer zone. Fire, fire suppression, post-fire salvage, and thinning/control burns to reduce fuel have probably affected deer habitat in the last decade. In portions of important range in GMU's 340 and 342, fire/human alteration has generally increased browse production. The exception has been in more arid portions of GMU 342 where fires have converted shrub-steppe to grassland by removing sagebrush and affecting other shrub cover. Thinning/burning in GMU 352 appears to have converted many areas to park- like ponderosa pine/grass. Radio-marked deer have made limited use of those areas.

Human-Wildlife Interaction

Deer conflicts with agriculture in the Naches MDMZ are typically minimal. In 2018-19, there were 40 damage prevention and 7 landowner kill permits issued. Total known harvest on the permits was 6 deer.

Management Concerns

The largest concern in the Naches MDMZ is that deer density remains well below historic levels. Surveys and harvest indicate the population is at one of the lowest levels in modern history. During ideal conditions, the population creeps slightly higher, but likely is limited by cougar predation. During recent drought and moderate winters, population declines were significant. Bleich and Taylor (1998) and Robinson et al. (2002) found cougar predation was a limiting factor in some deer populations, but also suggested other factors could be involved. The same may be true in the Naches MDMZ. Cougars are a significant cause of mortality for deer in this zone, but it is unknown if habitat is also a factor. Cougar predation is not likely the cause of the deer decline but may be a factor affecting the pace and scale of population recovery.

Wildfires, thinning, and control burns are increasing and may increase browse production in more moist forest zones. In shrub-steppe, fires have converted the range to grass. "Restoration" in arid environments is rarely successful, especially in shallow soil. "Restoration" often also involves native plants only, which may limit potential benefits to deer. In light winters following summers with adequate moisture, the population will increase slowly, but will significantly decline during droughts and moderate to severe winters.

Management Conclusions

Mule deer populations in the Naches MDMZ are low compared to historic levels. Recent data suggest the population may not recover to historic levels in the near future without other management actions. There is a trend towards hotter and drier summers, which will make any recovery more difficult. The buck population is typically within the minimum management objective of 15-19 bucks per 100 does. Survey approaches in this MDMZ are still being refined.

Literature Cited

Bernatowicz, J. A., K. Mansfield, J. W. Mertins, and W. Moore. 2011. Hair-loss syndrome in deer in south-central Washington. *in* McCorquodale, S. M., ed. Proceedings of the 8th Western States and Provinces Deer and Elk Workshop – 2009. Washington Department of Fish and Wildlife, Olympia.

Bishop, C. J., J. W. Unsworth, and E. O. Garton. 2005. Mule deer survival among adjacent populations in southwest Idaho. Journal of Wildlife Management 69:311-321.

Bleich, V.C., and Taylor, T.J. 1998. Survivorship and cause-specific mortality in five populations of mule deer. Great Basin Naturalist 58:265–272.

Hurley, M. A., J. W. Unsworth, P. Zager, M. Hebblewhite, E. O. Garton, D. M. Montgomery,J. R. Skalski, and C. L. Maycock. 2011. Demographic response of mule deer to experimental reduction of coyotes and mountain lions in southeastern Idaho. Wildlife Monographs 178.

Monteith, K. L., V. C. Bleich, T. R. Stephenson, B. M. Pierce, M. M. Conner, J. G. Kie, and R. T. Bowyer. 2014. Life-history characteristics of mule deer: effects of nutrition in a variable environment. Wildlife Monographs 186.

Robinson, H. S., R. B. Wielgus, and J. C. Gwilliam. 2002. Cougar predation and population growth of sympatric mule deer and white-tailed deer. Canadian Journal of Zoology 80:556-568.

Unsworth, J. W., D. F. Pac, G.C. White, and R. M. Bartmann. 1999. Mule deer survival in Colorado, Idaho, and Montana. Journal of Wildlife Management 63: 315-326.

Washington Department of Fish and Wildlife. 2013. Game status and trend report. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA.

Washington Department of Fish and Wildlife. 2016. Washington State Mule Deer Management Plan, Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA, USA. 144p.

Northern Rocky Mountains Mule Deer Management Zone

ANNEMARIE PRINCE, Wildlife Biologist
BEN TURNOCK, Wildlife Biologist
MIKE ATAMIAN, Wildlife Biologist
CARRIE LOWE, Wildlife Biologist

Introduction

The Northern Rocky Mountains MDMZ is located in northeast Washington and consists of six GMUs (105, 108, 111, 113, 117, and 124; Figure 1).

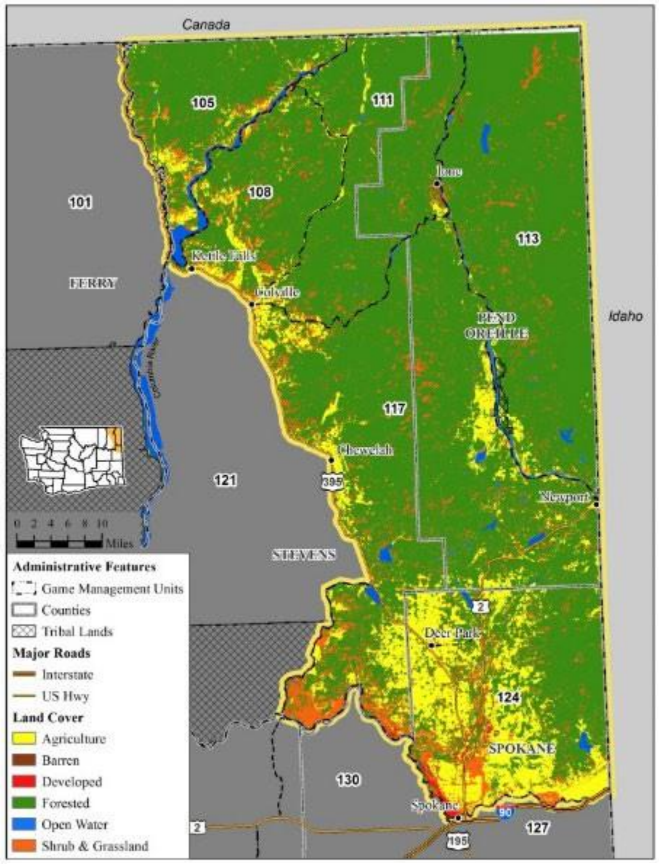


Figure 1. GMUs and generalized land cover types within the Northern Rocky Mountains MDMZ.

Management Guidelines and Objectives

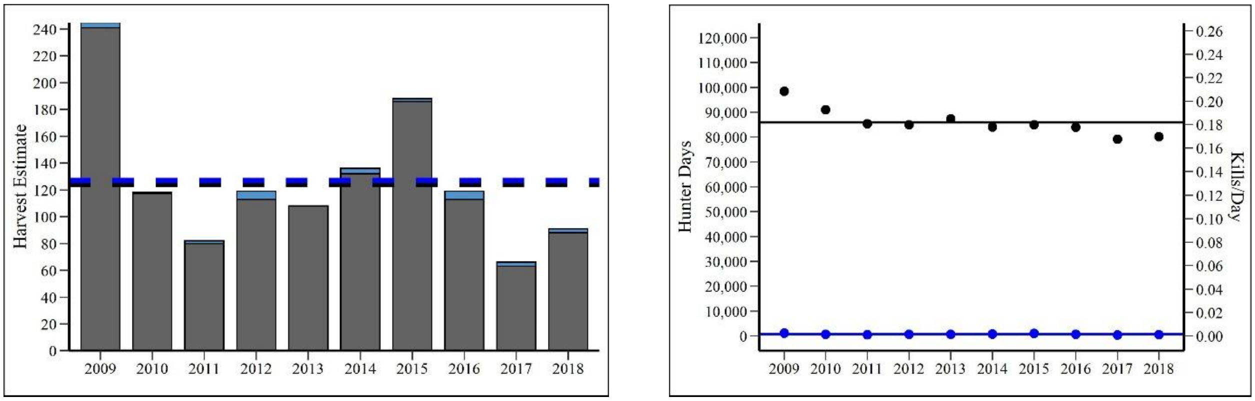
The Department's objective within this MDMZ is to maintain a stable population, based on harvest estimates and other best-available information. Additional management objectives include managing for a post-hunt population with a sex ratio of 15-19 bucks:100 does. While mule deer are present at low numbers, the habitat is better suited to white-tailed deer which are the primary focus of management in this zone.

Population Surveys

No estimates of mule deer abundance are available for populations within this zone, but the overall mule deer numbers are low given the limited high-quality mule deer habitat in the zone.

Hunting Seasons and Recreational Harvest

Subsequent to 2009, harvest estimates have fluctuated over time (Figure 2a). Estimates of hunter effort (i.e., hunter days; Figure 2b) and harvest rate (i.e., kills/day; Figure 2b) in this zone include days spent hunting white-tailed deer as well, and are consequently skewed with regard to mule deer-specific harvest. Because this zone is predominantly hunted for white-tailed deer, the true number of days spent hunting only mule deer are substantially lower, and harvest rates higher, than indicated.



a) b)

Figure 2. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray) and General + Permit State Harvest (blue); and (b) general season estimates and 10-yr mean for hunter days (black) and kills/day (blue); in the Northern Rocky Mountains MDMZ, 2009–2018.

Survival and Mortality

No estimates of pregnancy, fetal, or survival rates are available for mule deer herds in the Northern Rocky Mountains MDMZ. Cougars, black bears, grizzly bears, and coyotes occur within this MDMZ, as well as 7 wolf packs as of December 31, 2018 (Washington Department of Fish and Wildlife et al. 2019). The effects of predation on this population of mule deer are unknown.

Habitat

Habitat within the Northern Rocky Mountains MDMZ is predominantly conifer forest, comprising over 70 % of the total land cover within the zone. Forest types include dry forest at low elevations, mainly composed of ponderosa pine and Douglas-fir, to high elevation forest composed of subalpine fir, western larch, Engelmann spruce, whitebark pine, and lodgepole pine. More mesic sites at any elevation contain western red cedar, western hemlock, and grand fir. Outside the winter season mule deer tend to be found at high elevation ridges and basins, except in GMU 124 where they are found year around along the Spokane River and associated tributaries. Most of these high elevation summer ranges are on public land managed for multiple uses, including wildlife conservation. Lands under private ownership are typically managed for long-term timber production. Hence, there appears to be little threat of habitat conversion on mule deer summer ranges within the Northern Rocky Mountains MDMZ. The one exception to this is in GMU 124 where residential development along the Spokane River and tributaries is resulting in loss of habitat. Mule deer are apparently adapting to this development and are often reported as nuisance or damage issues in the towns along the river.

Human-Wildlife Interaction

Most mule deer observed within the Northern Rocky Mountains MDMZ are in places where the deer are generally appreciated. Hence, there have been no conflicts reported specific to mule deer, outside of the Spokane area, and all Damage Prevention Cooperative Agreements filed within this zone have been specific to conflicts with white-tailed deer in low elevation farmlands. Within the Spokane area the conflicts with mule deer have typically involved damage to landscaping, and human safety issues, predominantly vehicle deer collisions along Hwy 291 and Northwest Blvd. have also occurred.

Management Concerns

The primary management concerns for mule deer in the Northern Rocky Mountains MDMZ are that numbers appear to be low and restricted in range by suitable habitat,

Management Conclusions

Mule deer populations in the Northern Rocky Mountains MDMZ are not considered to be at risk based upon hunter harvest metrics. The estimated harvest for 2018 was below the 10-year average, and the third lowest harvest observed in the last 10 years.

Literature Cited

Washington Department of Fish and Wildlife, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Washington Department of Fish and Wildlife, Ellensburg, WA, USA.

Washington Department of Fish and Wildlife. 2016. Washington State mule deer management plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA. 144 p.

Okanogan Highlands Mule Deer Management Zone

BEN TURNOCK, Wildlife Biologist
ANNEMARIE PRINCE, Wildlife Biologist
SCOTT FITKIN, Wildlife Biologist

Introduction

The Okanogan Highlands MDMZ is located in north-central Washington and includes GMUs (101, 121, and 204; (Figure 1).

Management Guidelines and Objectives

The Department's objective within this MDMZ is to maintain a stable population based on field surveys and harvest estimates. Additional management objectives include managing for a post-hunt population with a sex ratio of 15-19 bucks:100 does.

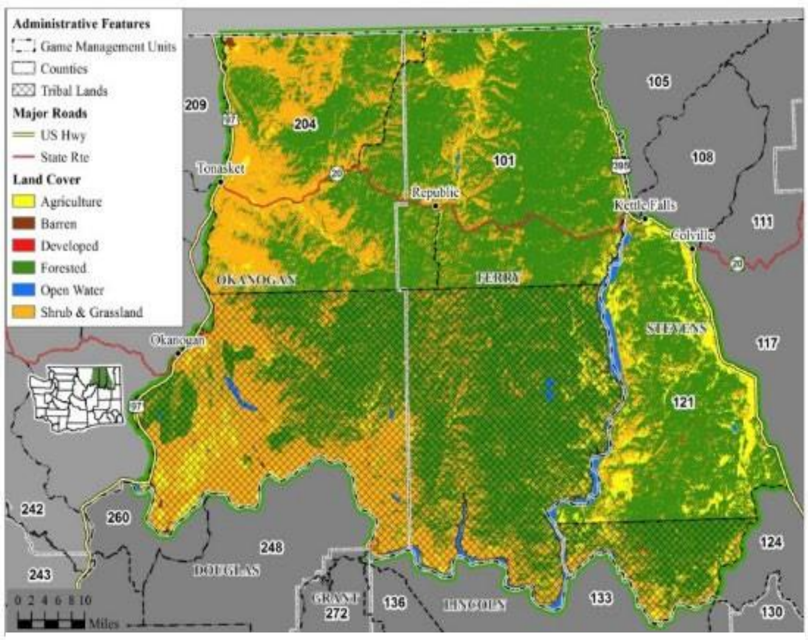


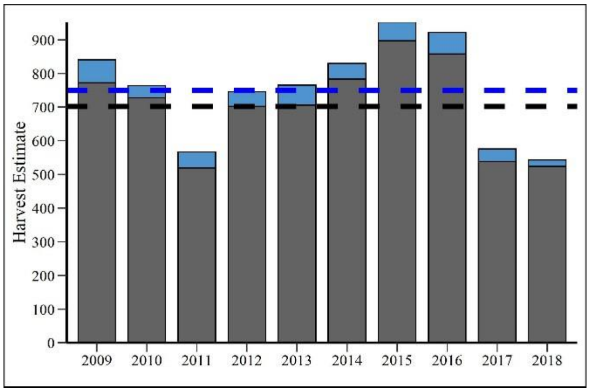
Figure 1. GMUs and generalized land cover types within the Okanogan Highlands MDMZ

Population Surveys

Mule deer are present throughout the Okanogan Highlands MDMZ, but they are more common in the western portion. Pre-hunt road surveys are conducted for white-tailed deer in the eastern portion of the zone, but sample sizes are not sufficient to provide useful information for mule deer.

Hunting Seasons and Recreational Harvest

Harvest trends for the past 10 years have been relatively stable (Figure 2a). Hunter days have declined in recent years due to shortened season length and kills/day have remained stable (Figure 2b).



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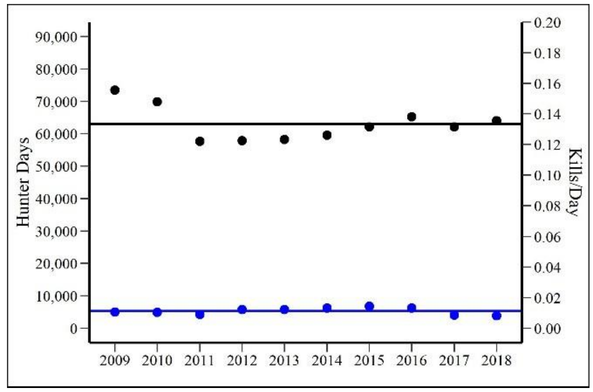


b)

Figure 2. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray) and General + Permit State Harvest (blue); and (b) general season estimates and 10-yr mean for hunter days (black) and kills/day (blue); in the Okanogan Highlands MDMZ, 2009 – 2018.

Survival and Mortality

A study involving adult female mule deer in the zone, conducted between 2000 and 2007, indicated survival ($\hat{\boldsymbol{s}}$ = 0.89, 95% CI = 0.87 – 0.91), pregnancy rates ($\hat{\boldsymbol{p}}$ = 0.93, 90%CI = 0.81 – 1.00), and fetal rates ($\hat{\boldsymbol{f}}$ = 1.44, 90% CI = 1.03 – 1.85) in the Okanogan Highlands MDMZ were sufficient to support stable populations (WDFW 2016). The study also found that cougars and deer-vehicle collisions were the most common sources of mortality (WDFW 2016). As of 2014, the Department has been working in collaboration with the University of Washington to provide updated survival information for this zone over the next few years. Predators in the Okanogan Highlands MDMZ include cougars, black bears, coyotes, golden eagles, and wolves (11 wolf packs, occurring mostly in the eastern portion of the zone, have been documented as of December 31, 2018; WDFW 2019).

Habitat

Habitat within the Okanogan Highlands MDMZ is predominantly conifer forest, contributing approximately 61% of the total land cover within the zone. Shrub lands combined with upland grass and herbaceous along with agricultural lands make up the next highest level in land cover classes, altogether comprising approximately 33% of the Okanogan Highlands MDMZ area. The Okanogan Highlands MDMZ can also be broken down to about 28% public land and 27% private lands with the remaining 45% comprised of the Colville and Spokane Indian Reservations (WDFW 2016).

Threats to habitat quality within the Okanogan Highlands MDMZ include continued development and fragmentation of low-elevation habitats, increasing use and distribution of off-road vehicles, and increasing prevalence of invasive weeds. In 2015, approximately 272,800 acres were burned by multiple wildfires within the Okanogan Highlands MDMZ. The fires were of varying severities and in some areas mule deer habitat burned very intensely. In 2017, approximately 10,601 acres burned within the Okanogan Highlands MDMZ.

Human-Wildlife Interaction

Most deer conflict is restricted to the lower elevation irrigated agriculture lands throughout the Zone. Specific Deer Areas have been established in the western edge of this Zone with antlerless permit hunt seasons designed to target and reduce deer damage. Permit numbers within each Deer Area fluctuate with the level of reported damage incidents. To date, the program is operating smoothly and appears to be helpful in reducing deer damage complaints.

The town of Republic has a resident in-town mule deer population that causes property damage and poses a safety threat. In addition to the Deer Area permits, the town of Republic is generally issued kill permits on a yearly basis, so the local police department can address deer issues.

Damage Prevention Cooperative Agreements (DPCA) and Kill permits are also conservatively issued to reduce deer damage throughout the Zone. In 2018, WDFW Conflict Specialists issued 9 damage prevention permits and 2 kill permits to address deer damage throughout the entire Okanogan Highlands MDMZ.

Research

There is no research being conducted on mule deer in the Okanogan Highlands MDMZ.

Management Concerns

Approximately 28% of the land base comprising the Okanogan Highlands MDMZ is in public ownership. Thus, maximizing hunting opportunities largely depends on securing access to private lands. Major sources of mortality to deer, other than hunting, in this zone include predation by native carnivores and vehicle collisions. Severe winter conditions periodically result in a decline in over-winter survival of mule deer in this zone, generally affecting fawns more so than adults. The influence of these factors can complicate how best to balance deer hunting opportunity with herd sustainability.

Management Conclusions

Mule deer populations in the Okanogan Highlands MDMZ are considered stable based on harvest data trend.

Literature Cited

Dellinger, J.A., Shores, C.R., Marsh, M., Heithaus, M.R., Ripple, W.J. and Wirsing, A.J., 2018. Impacts of recolonizing gray wolves (Canis lupus) on survival and mortality in two sympatric ungulates. Canadian Journal of Zoology, 96(7) 760-768.

Washington Department of Fish and Wildlife. 2016. Washington State Mule Deer Management Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA. 144 p.

Washington Department of Fish and Wildlife, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Washington Department of Fish and Wildlife, Ellensburg, WA, USA.

Blue Mountains White-tailed Deer Management Zone

MARK VEKASY, Wildlife Biologist
PAUL WIK, Wildlife Biologist

Introduction

The Blue Mountains White-tailed Deer Management Zone (WDMZ) is located in southeast Washington and consists of 11 GMUs (154, 157, 162, 163, 166, 169, 172, 175, 178, 181, and 186; Figure 1).

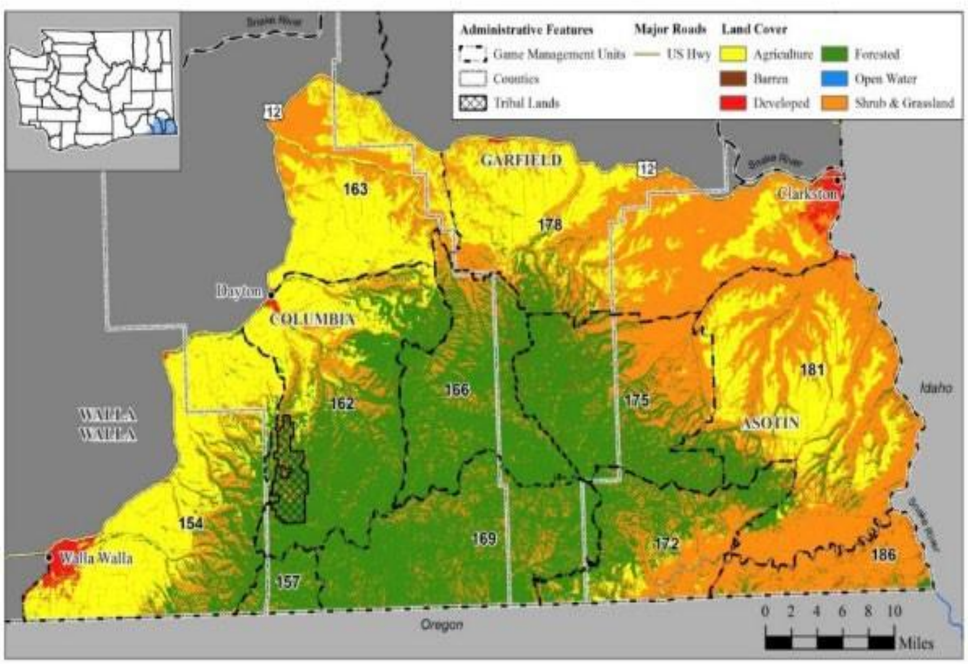


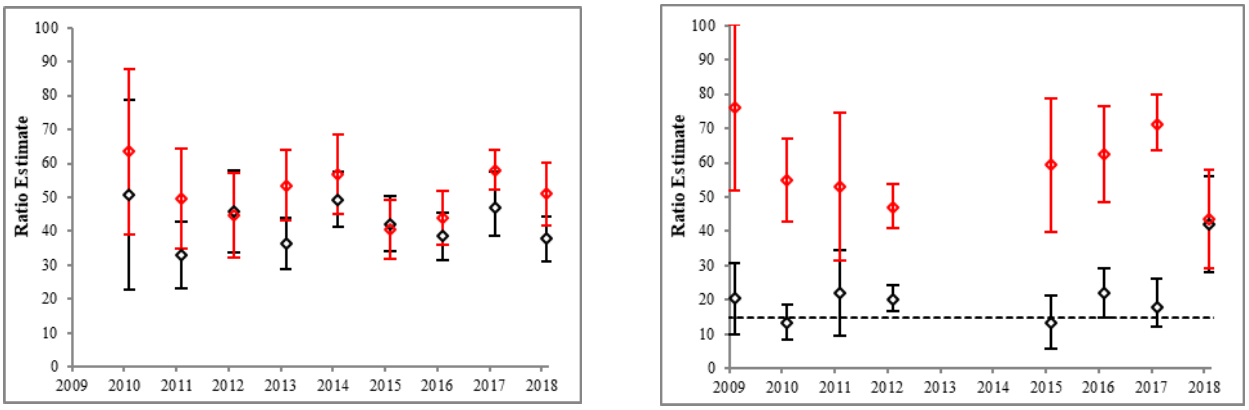
Figure 1. GMUs and generalized land cover types within the Blue Mountains WDMZ.

Management Guidelines and Objectives

The Department's objective within this WDMZ is to maintain a stable population based on available survey data and harvest estimates. Additional management objectives include managing for a post-hunt population with a sex ratio of 15-19 bucks:100 does (WDFW 2010).

Population Surveys

White-tailed deer occur throughout the zone, but densities are generally greater in the foothills, riparian corridors, and higher-elevation agricultural areas. Pre-hunt ground surveys are conducted each year to estimate sex and age ratios for both mule deer and white-tailed deer in portions of the zone and some information is recorded for white-tailed deer during post-hunt aerial mule deer surveys. Estimates vary widely from year to year, with a 10-year pre-hunt mean of 42 bucks:100 does and 51 fawns:100 does, and our 2018 monitoring effort resulted in values similar to those means, with 38 bucks:100 does and 51 fawns:100 doe ratios (Figures 2a and 2b). Road surveys for ratio estimates are not adequate to obtain a population estimate.

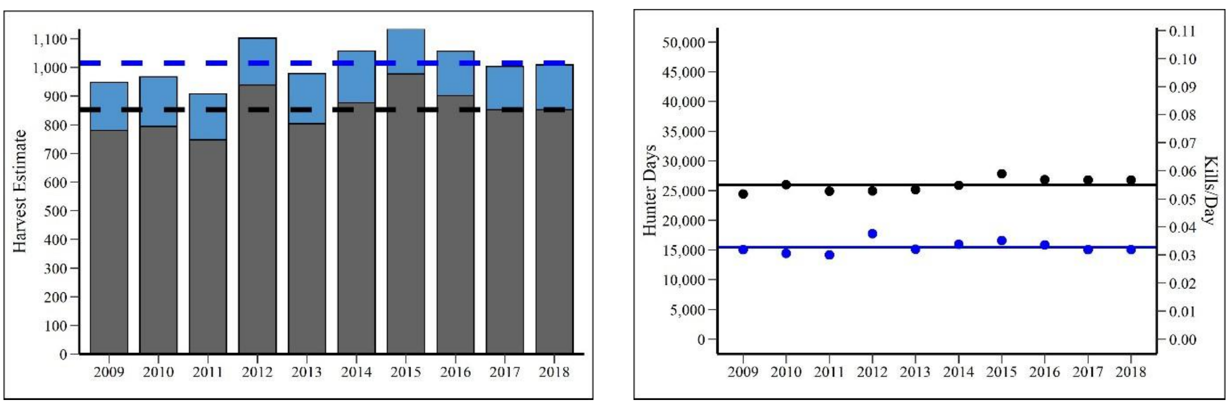


a) b)

Figure 2. Estimates of buck (black) and fawn (red) ratios per 100 does and post-hunt buck objectives (dashed line) from, (a) pre-hunt (ground-based) and (b) post-hunt (aerial and ground) composition surveys in the Blue Mountains WDMZ, 2009–2018. Years where ground counts were below 100 deer have been excluded.

Hunting Seasons and Recreational Harvest

Harvest estimates for the past 10 years (Figure 3a) have been stable, as have the number of hunter days and kills/day (Figure 3b). Average hunter harvest is 843 white-tailed deer per season, with a harvest of 853 estimated for the 2018 season. Estimates of hunter days and kills/day are for white-tailed and mule deer combined. The numbers of permits issued varies by year, particularly for antlerless deer, depending on factors affecting the population (disease occurrence and severity, winter severity, drought, etc.) and levels of agricultural damage; therefore, the trend in permit harvest is not a good indicator of overall population condition.



a) b)

Figure 3a: Harvest estimates and 10-yr means (dashed lines) for a: General (gray) and Permit (blue); and Figure 3b: General season estimates (points) and 10-yr mean (solid lines) for hunter days (black) and kills/day (blue); in the Blue Mountains WDMZ, 2009–2018.

Survival and Mortality

No estimates of pregnancy, fetal, or survival rates are available for white-tailed deer herds in the Blue Mountains WDMZ. In addition to legal hunter harvest, other potential sources of white- tailed deer mortality include predation, collisions with vehicles, disease (EHD and Bluetongue), and poaching. Predator species living within this zone include cougar, wolves, bobcat, black bear, coyote, golden eagles, and domestic dogs.

Habitat

Similar to mule deer in this area, white-tailed deer populations are generally habitat limited. Habitat limitations include conversion to croplands from CRP, grazing by domestic livestock, wildfire suppression, invasion of noxious weeds, extensive wind power development, and urban-suburban development that have been detrimental to available habitat in this zone. Dry conditions that develop during the summer growing season, particularly on the east side of the Blue Mountains, are likely a limiting factor to productivity for white-tailed deer, and we observe more white-tailed deer on the west side of the District.

Human-Wildlife Interaction

The agricultural damage prevention program is managed by WDFW Wildlife program to minimize crop damage through multiple actions, such as issuance of permits in designated Deer Areas, hazing deer out of fields or away from haystacks, and Damage Prevention Cooperative Agreement (DPCA) permits. Landowners are entitled to 2 free kill permits under the DPCA contract, with the requirement of reporting harvest directly to the Conflict Specialist. Kill Permits make up the majority of damage tags given to landowners. Any additional permits are issued as damage permits with the requirement that the landowner, leasee, or their designee purchase a damage tag and report harvest through the licensing system. Most of the harvest has occurred where there would be very little hunting opportunity otherwise, such as in the winery and orchard areas around Walla Walla. From July 2018 through March 2019, 23 hunters reported hunting their damage tag, with 17 reporting a harvest and 11 harvesting a white-tailed doe or antlerless deer. Conflict Specialists reported 15 landowners harvesting either a white-tailed or mule deer on a kill permit.

Management Concerns

One of the biggest management concerns for white-tailed deer in the District over the past decade has been the occurrence of epizootic hemorrhagic disease (EHD) or Bluetongue outbreaks. The disease is spread by a biting midge (*Culicoides* spp.), and outbreaks generally occur during drought years when there is limited open water and ample mud for midge breeding habitat, and deer are concentrated near water sources. Our only management option is to gauge the severity of the outbreak and adjust antlerless permits as appropriate. Habitat conversion is an ongoing issue that has mainly resulted in increasing white-tailed deer damage conflicts. Expansion of residential areas and conversion of crop acreage to wineries and orchards has brought deer into conflict with landowners by eating ornamental shrubs, fruit trees, and vines.

Management Conclusions

White-tailed deer composition metrics in the Blue Mountains WDMZ are currently at management objective for post-hunt buck:doe ratios, and harvest data support the belief that the population is stable where habitat availability and quality allow.

Literature Cited

Washington Department of Fish and Wildlife. 2010. Washington State Deer Management Plan: White-tailed Deer. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA. 124 p.

Columbia Basin White-tailed Deer Management Zone

MICHAEL ATAMIAN, Wildlife Biologist
CARRIE LOWE, Wildlife Biologist
SEAN DOUGHERTY, Wildlife Biologist
ELLA ROWAN, Wildlife Biologist
JASON FIDORRA, Wildlife Biologist

Introduction

The Columbia Basin White-tailed Deer Management Zone (WDMZ) is located in east-central Washington and consists of 8 GMUs (136, 272, 278, 284, 290, 373, 379, and 381; Figure 1).

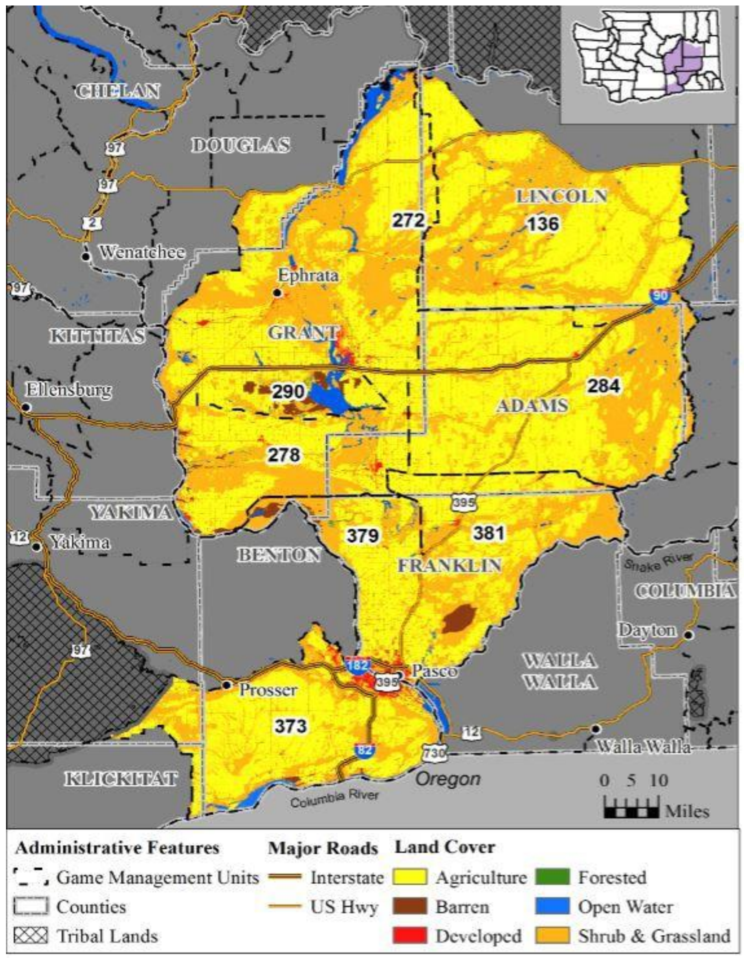


Figure 1. GMUs and generalized land cover types within the Columbia Basin WDMZ.

Management Guidelines and Objectives

The Department's objective within this WDMZ is to maintain a stable population based on harvest trends. The Columbia Basin is not optimal white-tailed deer habitat and there is no management objective to change the distribution or numbers of the few white-tailed deer that reside there (WDFW 2010).

Population Surveys

GMUs within this zone are primarily managed for mule deer, but white-tailed deer are present at low densities throughout the Columbia Basin WDMZ. No survey work specific to white-tailed deer is being conducted in this WDMZ at this time.

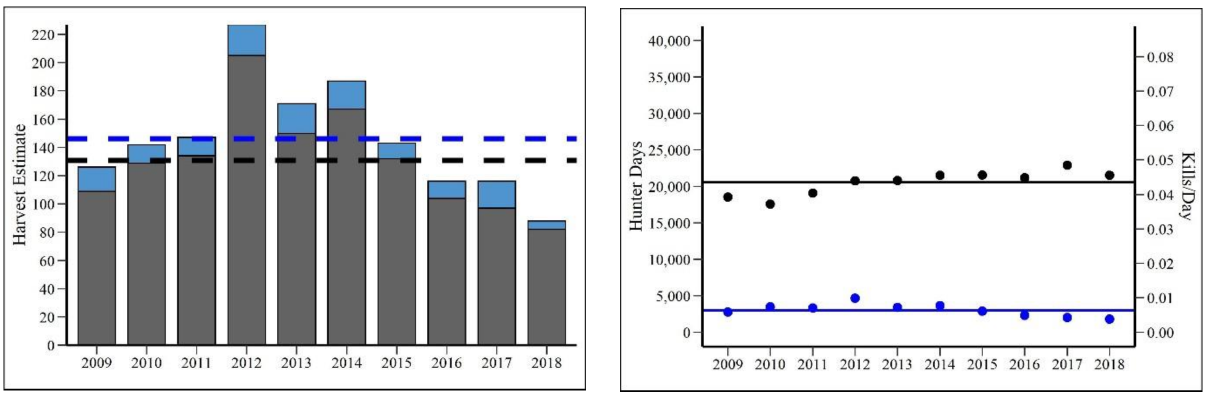
Hunting Seasons and Recreational Harvest

Estimated harvest is low overall for this zone, reflective of the availability of preferred habitat for white-tailed deer (Figure 2a). Harvest has been relatively stable over the past decade but declining the past five years (Figure 2a). Measures of hunter effort (hunter days; Figure 2b) and harvest rate (kills/day; Figure 2b) in the zone include days spent hunting all deer (i.e., mule deer) so are less useful as indicators of population trend but have remained relatively stable the past ten years. The decline in harvest and kills/day since 2015 is likely due to the 2015 drought and associated

Bluetongue (BT) outbreak resulting in reduced white-tailed deer numbers and recruitment. The continued trend in lower harvest in 2018 is likely due to the population still having not fully recovered from the 2015 BT outbreak and suffering a minor outbreak of Epizootic hemorrhagic disease (EHD) in 2018 in the northeastern GMU 136 where a significant amount of white-tail harvest for this zone traditionally occurs. Additionally, hunter success and effort in this zone is correlated to access to private land (86% of the zone is private land) if private landowners are not opening their land to hunters due to perceived low white-tailed deer numbers this can have a marked effect on harvest.

Survival and Mortality

No estimates of pregnancy, fetal, or survival rates are available for white-tailed deer in the Columbia Basin WDMZ. Similar to mule deer, other sources of mortality in this zone likely include collisions with vehicles, drowning in irrigation canals, poaching, and predation. Predator species living within this zone include cougars, bobcats, black bears, gray wolves (transients have been observed but there are no known packs confirmed within this WDMZ at the time of this writing), coyotes, golden eagles, and domestic dogs. Black bears are not common in open shrub-steppe landscapes but do occur at low levels in some parts of the Columbia Basin. Cougars are comparatively more common.



a) b)

Figure 2. Harvest estimates and 10-yr means (dashed lines) for General State Harvest (gray) and General + Permit State Harvest (blue); a), and general season estimates and 10-yr mean for hunter days (black) and kills/day (blue); b) in the Columbia Basin WDMZ, 2008–2017.

Habitat

The Columbia Basin zone represents the periphery of white-tailed distribution in central Washington, and habitats present are generally more suitable for mule deer. The overall numbers of white-tailed deer are low in all GMUs within the zone; generally, white-tailed deer are found mostly in the eastern portion of the zone and in association with habitats of very limited extent, such as riparian areas along creeks and streams, CRP grasslands, and non-intensive agricultural tracts. White-tailed deer use in the extensive tracts of shrub-steppe within the zone is not common.

Human-Wildlife Interaction

Given the relatively small number of white-tailed deer in this zone, there are no significant white-tailed deer specific issues.

Management Concerns

Drought and loss of riparian habitat are the most important issues facing white-tailed deer in the Columbia Basin WDMZ. Disease is also a concern in this zone, which regularly has deer mortalities due to BT and EHD. These mortality events are typically small in number and isolated, however in drought years the number of mortalities can be high and widespread. The western and southern portion of the WDMZ have had a low level of occurrence of these pathogens but has lower numbers of white-tailed deer.

Management Conclusions

White-tailed deer populations in the Columbia Basin WDMZ are currently within management objective based on harvest data that indicate a stable to slightly declining population.

Literature Cited

Washington Department of Fish and Wildlife. 2010. Washington State deer management plan: white-tailed deer. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA. 124 p.

North Cascade Mountains White-tailed Deer Management Zone

SCOTT FITKIN, Wildlife Biologist
JEFF HEINLEN, Wildlife Biologist

Introduction

The North Cascade Mountains White-tailed Deer Management Zone (WDMZ) is located in north- central Washington and consists of 11 GMUs (209, 215, 218, 224, 231, 233, 239, 242, 243, 247, and 250; Figure 1).

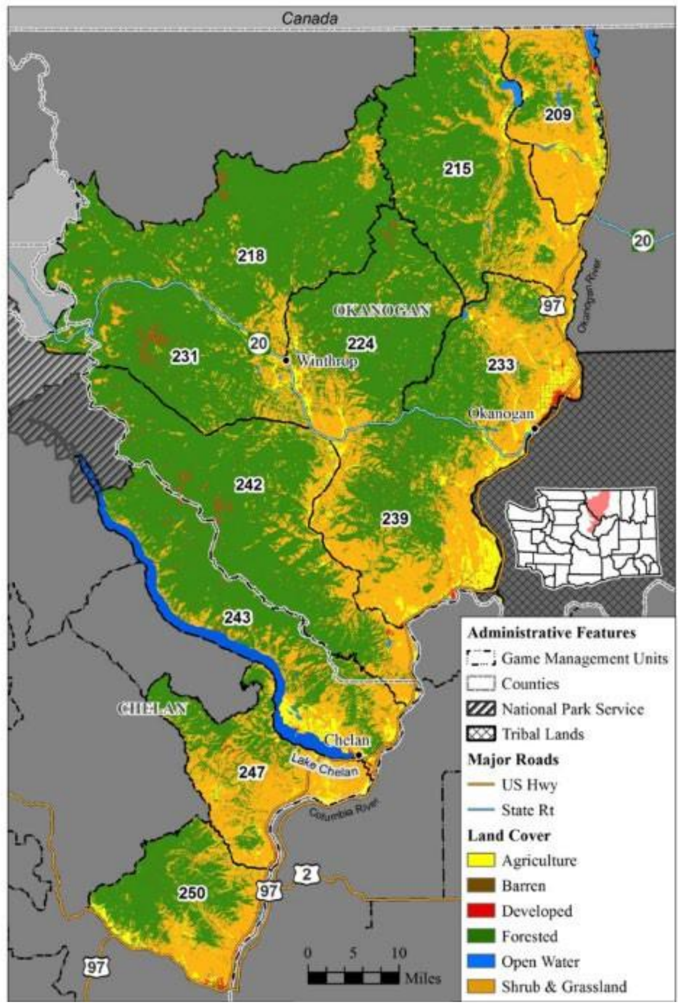


Figure 1. GMUs and generalized land cover types within the North Cascade Mountains WDMZ.

Management Guidelines and Objectives

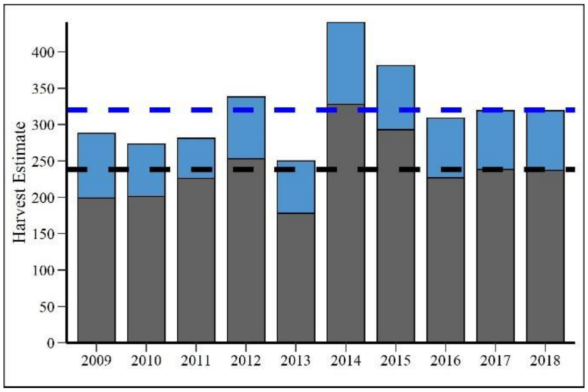
The Department's objective within this WDMZ is to maintain stable populations based on harvest estimates (WDFW 2010).

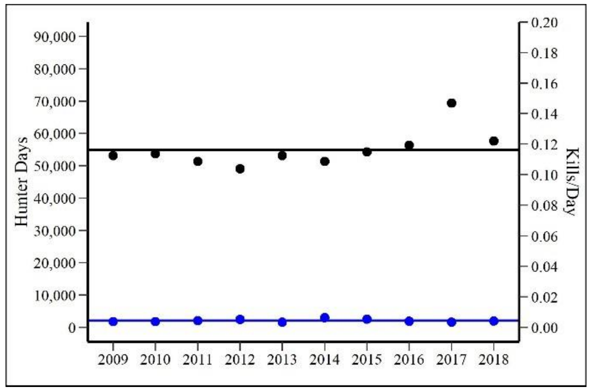
Population Surveys

GMUs within the North Cascade Mountains WDMZ are primarily managed for mule deer, but white-tailed deer are present at low densities throughout the zone. No formal surveys uniquely designed for white-tailed deer are conducted in this WDMZ.

Hunting Seasons and Recreational Harvest

Harvest estimates for the last 10-years have been low compared with mule deer harvest but relatively stable (Figure 2a). Estimates of hunter effort (which include mule deer hunters) and harvest rates have been variable in recent years, generally tracking the trends seen with mule deer (Figure 2b). This is to be expected since many hunters will harvest either species opportunistically during the general seasons.





a) b)

Figure 2. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray) and General + Permit State Harvest (blue); and (b) general season estimates and 10-yr mean for hunter days (black) and kills/day (blue); in the North Cascade Mountains WDMZ, 2009–2018.

Survival and Mortality

No estimates of pregnancy, fetal, or survival rates are available for white-tailed deer in the North Cascade Mountains WDMZ. Mortality sources in this zone include legal hunting, vehicle collisions, domestic dogs, poaching, and predation. Several predators occur within the North Cascade Mountains WDMZ including coyotes, black bears, cougars, and wolves (2 wolf packs have been documented within the zone as of this writing), the effects of predation on white-tailed deer in this zone are unknown, but not believed to be population limiting.

Habitat

Habitat related considerations in this zone include continued development and fragmentation of low-elevation habitats, increasing use and distribution of off-road vehicles, and increasing prevalence of invasive weeds.

Human-Wildlife Interaction

Most deer conflict is restricted to the lower elevation irrigated agriculture lands throughout the Zone. Specific Deer Areas have been established in the northern portion of this Zone with antlerless permit hunt seasons designed to target and reduce deer damage. Permit numbers within each Deer Area fluctuate with the level of reported damage incidents. To date, the program is operating smoothly and appears to be helpful in reducing deer damage complaints.

Damage Prevention Cooperative Agreements (DPCA) and Kill permits are also conservatively issued to reduce deer damage throughout the Zone. In 2018, WDFW Conflict Specialists issued only 20 deer (Mule or White-tailed deer) permits to address deer damage throughout the entire North Cascade Mountains WDMZ.

Significant roadkill occurs in the northern portion of this zone in the Methow Valley and along a 12.5-mile segment of State Highway 97. The Okanogan Trails Mule Deer Foundation Chapter and others are working with the Washington Department of Transportation to create underpasses along Hwy 97 to reduce roadkill and provide safer passage.

Management Concerns

Recent extensive loss of winter-range shrub forage to wildfires is the primary management concern in the northern three-fourths of the zone. Riparian shrubs are beginning to recover nicely; however, dryland shrub recovery is spotty and proceeding more slowly. Modest temporary increases in antlerless harvest were implemented for a few years in the most heavily impacted GMUs. The objective of these changes was to stabilize or slightly decrease the local population in the short-term to bring deer numbers in line with the landscape's reduced carrying capacity and avoid over-browsing of recovering winter range shrubs. For the 2019 season, antlerless permit levels are back to pre-fire levels.

Management Conclusions

White-tailed deer populations in the North Cascade Mountains WDMZ are currently at management objective and harvest estimates indicate a stable to slightly growing population.

Literature Cited

Washington Department of Fish and Wildlife. 2010. Washington State deer management plan: white-tailed deer. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA. 124 p.

Okanogan Highlands White-tailed Deer Management Zone

JEFF HEINLEN, Wildlife Biologist
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Introduction

The Okanogan Highlands White-tailed Deer Management Zone is located in north-central Washington and includes GMUs 101 and 204 (Figure 1).

Management Guidelines and Objectives

The Department's objective within this WDMZ is to maintain stable populations based on field surveys and harvest estimates. Additional management objectives include managing for a post-hunt population with a sex ratio of 15-19 bucks:100 does (WDFW 2010).

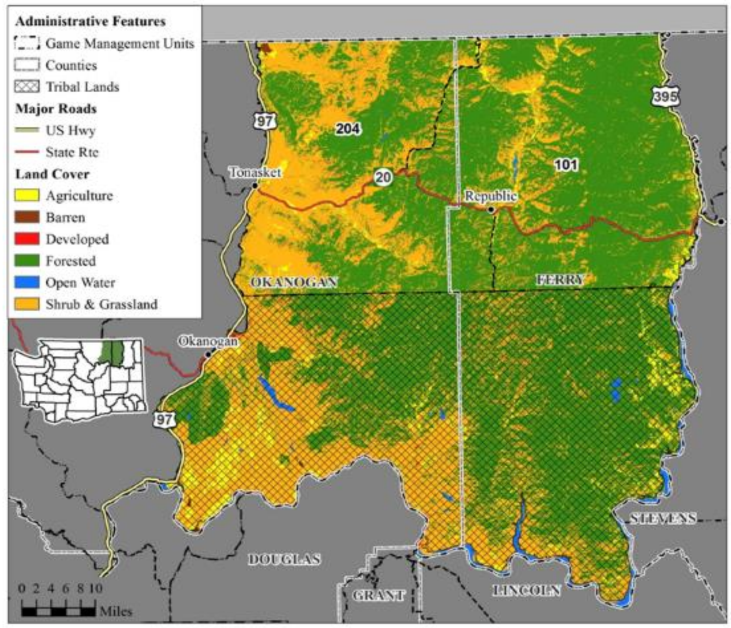


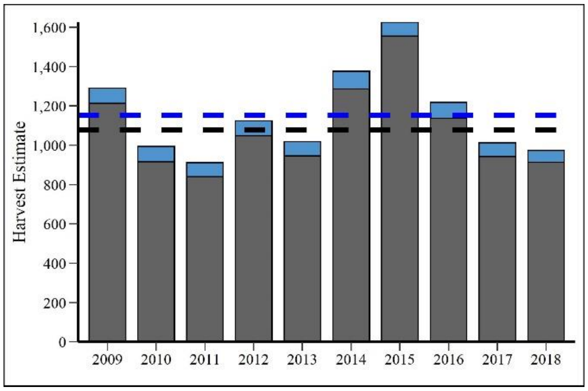
Figure 2. GMUs and generalized land cover types within the Okanogan Highlands WDMZ.

Population Surveys

White-tailed deer are present throughout the Okanogan Highlands WDMZ but are more common in the eastern portion. Because estimates of total white-tailed deer abundance in this zone are not practical, pre-hunt ground surveys are conducted in the eastern half of the zone to estimate buck:doe ratios (a rough annual measure of the effect of harvest on the population) over time. The pre-hunt buck:doe ratio estimate for 2018 was 35:100 (n = 116) and is consistent with the average ratio for the last 7 years (2011 – 2017) of 32:100 (range = 24 - 38, n = range of 116 - 266 deer classified each year). However, the forested landscape and limited visibility experienced during road surveys in this zone generally result in low sample sizes, which prevent calculation of confidence intervals and limit any conclusions that can be made about the status of population in the Okanogan Highlands.

Hunting Seasons and Recreational Harvest

Harvest estimates have been mostly stable over the last decade (Figure 2a). Except for a slight increase in 2015 of kills/day, number of hunter days reported, and kills/day have been stable (Figure 2b).



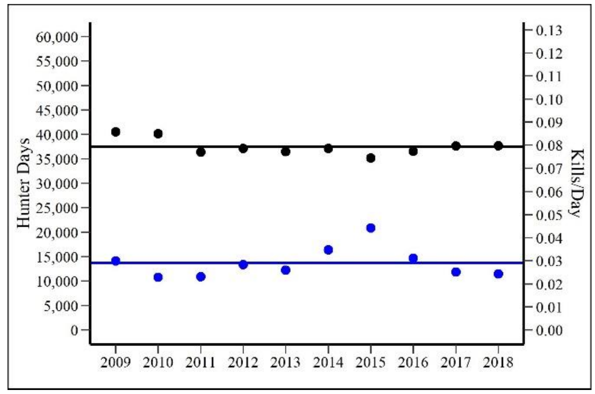


Figure 2. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray) and General + Permit State Harvest (blue); and (b) general season estimates and 10-yr mean for hunter days (black) and kills/day (blue); b) in the Okanogan Highlands WDMZ, 2008–2017.

Survival and Mortality

No estimates of pregnancy, fetal, or survival rates are available for white-tailed deer in the Okanogan Highlands WDMZ.

In addition to legal hunter harvest, other potential sources of white-tailed deer mortality include disease, poaching, collisions with vehicles, and predation. Predator species that occur within this zone include cougar, bobcat, black bear, gray wolf (9 packs were documented as of December 31, 2018; WDFW et al. 2019), coyote, golden eagles, and domestic dogs.

Habitat

Habitat within the Okanogan Highlands WDMZ is predominantly conifer forest, contributing approximately 55% of the total land cover within the zone. Shrub land combined with grassland, pasture, and cultivated crops make up the next highest level in land cover classes, altogether comprising approximately 41% of the Okanogan Highlands WDMZ area. These cover classes combined produce the highest densities of white-tailed deer, particularly in the valley bottoms where deer have both forage and cover resources in close proximity. Although cultivated crops alone account for only 0.7% of the aforementioned land cover, their influence on support of the white-tailed deer population cannot be overstated. The Okanogan Highlands WDMZ can also be broken down to about 31% public land and 19% private lands with the remaining 50% comprised of the Colville Indian Reservation (WDFW 2010).

Threats to habitat quality within the Okanogan Highlands WDMZ include continued development and fragmentation of low-elevation habitats, increasing use and distribution of off-road vehicles, and increasing prevalence of invasive weeds. In 2015, approximately 208,800 acres were burned by multiple wildfires within the Okanogan Highlands WDMZ.

Human-Wildlife Interaction

Most deer conflict is restricted to the lower elevation irrigated agriculture lands throughout the Zone. Specific Deer Areas have been established in the western edge of this Zone with antlerless permit hunt seasons designed to target and reduce deer damage. Permit numbers within each Deer

Area fluctuate with the level of reported damage incidents. To date, the program is operating smoothly and appears to be helpful in reducing deer damage complaints. Damage Prevention Cooperative Agreements (DPCA) and kill permits are also issued to reduce deer damage throughout the Zone.

Research

There is no ongoing research on white-tailed deer in the Okanogan Highlands WDMZ.

Management Concerns

As less than half the land base comprising the Okanogan Highlands WDMZ is in public ownership (31%), maximizing hunting opportunities largely depends on securing access to private lands. Closely coupled to this concern is the availability of cultivated crop land cover, particularly cereal grain and alfalfa hay to the deer. Cultivated crops are a major driver to white-tailed deer density and productivity in northeastern Washington and beyond. Besides hunting, the other major sources of mortality to deer in this zone include predation by both native carnivores and domestic dogs, and road kills from collision with automobiles. Periodically, but unpredictably, a severe winter will cause major deer loss. Also unpredictable are summer heat and drought that foster conditions for severe outbreaks of hemorrhagic disease. The influence of these diverse factors can greatly complicate how best to balance deer hunting opportunity with herd sustainability. The winter of 2018 was mild to moderate and there were no reported large outbreaks of hemorrhagic disease.

Management Conclusions

Although harvest data suggest white-tailed deer populations in the Okanogan Highlands WDMZ may have declined the last couple of years, harvest continues to fluctuate near the long-term average in line with at the management objective of population stability.

Literature Cited

Dellinger, J.A., Shores, C.R., Marsh, M., Heithaus, M.R., Ripple, W.J. and Wirsing, A.J., 2018. Impacts of recolonizing gray wolves (*Canis lupus*) on survival and mortality in two sympatric ungulates. Canadian Journal of Zoology, 96(7) 760-768.

Washington Department of Fish and Wildlife, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Washington Department of Fish and Wildlife, Colville, WA, USA.

Washington Department of Fish and Wildlife. 2010. Washington State deer management plan: white-tailed deer. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA. 124 p.

Palouse White-tailed Deer Management Zone

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MARK VEKASY, Wildlife Biologist
PAUL WIK, Wildlife Biologist
CARRIE LOWE, Wildlife Biologist

Introduction

The Palouse White-tailed Deer Management Zone is located in east-central Washington and consists of 7 GMUs in Districts 2 and 3 (127, 130, 133, 139, 142, 145, 149; Figure 1).

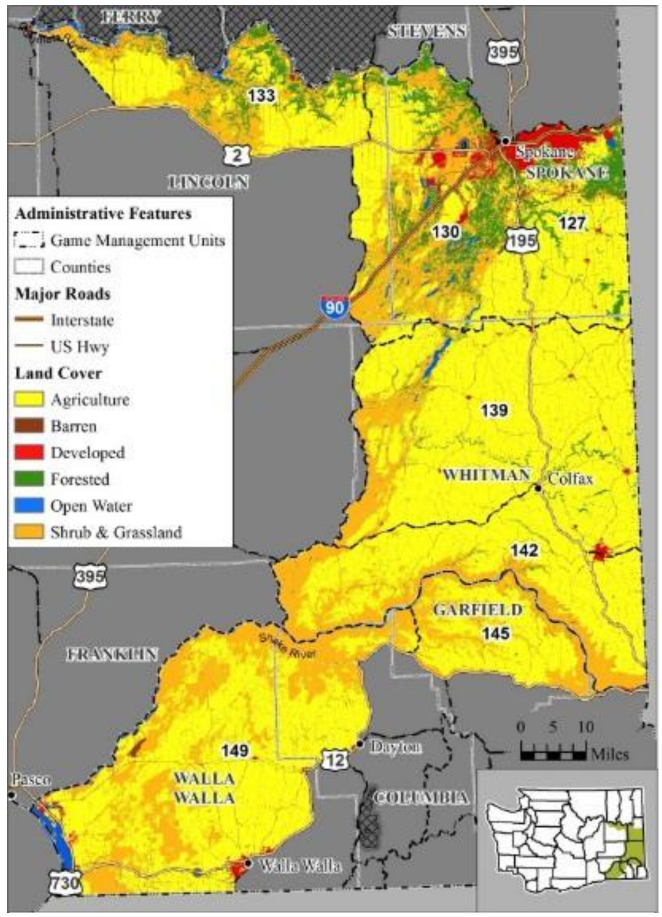


Figure 1. GMUs and generalized land cover types within the Palouse WDMZ

Management Guidelines and Objectives

The Department's objective within this WDMZ is to maintain a stable population based on available survey data and harvest trends. Additional management objectives include managing for a post- hunt population with a sex ratio of 15-19 bucks per 100 does (WDFW 2010).

Population Surveys

White-tailed deer are present at moderate to high densities throughout the Palouse WDMZ. The Palouse WDMZ is split into two areas for management purposes; the North Palouse comprised of those GMUs north of the Snake River (GMUs 127 – 142; District 2) and the South Palouse comprised of those GMUs south of the Snake River (GMUs 145 and 149; District 3).

South Palouse

White-tailed deer are not a management focus in the South Palouse; the area supports less than 20% of the total Palouse Zone white-tailed deer harvest, most of the management is directed towards mule deer, and any population information for white-tailed deer is incidental to that collected for mule deer. Pre-hunt ground surveys are conducted throughout the 2 GMUs, but sample sizes for white-tailed deer from ground composition surveys are too small and variable to be useful. For a baseline reference, we conducted an aerial survey in December 2017, sampling across portions of GMUs 145 and 149 and obtained a raw count of 669 white-tailed deer. We flew surveys following sightability model protocols, but the model was not designed nor validated for white-tailed deer, so we did not calculate a survey area estimate. The post-hunt buck:doe ratio was 31.8 (90% CI = 22.9-44.3), and the fawn:doe ratio was 65.6 (90% CI = 57.9-74.3). We conducted a survey in the same area but different subunits in 2018 and eliminated counts of white-tailed deer in some subunits due to poor weather conditions placing time constraints on the survey; therefore, those counts are not adequate for ratio estimates.

North Palouse

Pre-hunt ground surveys are conducted throughout the North Palouse. The goal of these surveys is to estimate deer herd composition not population size, therefore routes are altered annually, as needed, to reflect changes in habitat and agricultural crops. Routes are run twice each year; once in August for buck to doe ratios to estimate buck recruitment and once in September for fawn to doe ratios to estimate fawn production. Though the ratio data indicate stable recruitment of bucks, production of fawns dipped down in 2016 and 2017. Drought conditions and the associated Bluetongue (BT) outbreak in 2015 were likely factors in the decrease seen in 2016 (Figure 2) and a hard winter in 2016-17 likely contributed to the low production in 2017.

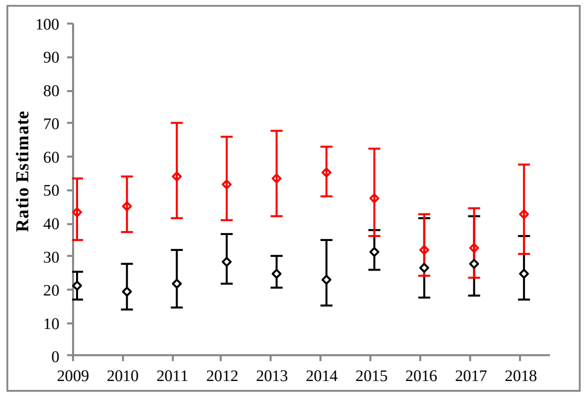


Figure 2. Estimated pre-hunt fawn:doe (◊) and buck:doe (◊) ratios and associated 90% confidence intervals in North Palouse WDMZ (GMUs 127 – 142), 2009–2018.

There was a small isolated Epizootic hemorrhagic disease (EHD) outbreak in the northwest of this zone in 2018, however the winter of 2017-18 was a mild winter and fawn production appears to have rebounded in 2018. Ratio estimates should not be interpreted as an index to population abundance; they are a relative annual measure of the effect of harvest and reproduction of deer populations and provide a general indication of whether a population is stable, increasing, or decreasing. In conjunction with harvest estimates, these measures are used to inform management decisions each year.

Hunting Seasons and Recreational Harvest

Harvest has declined by over 30% during the past four years compared to high levels during 2012-2014 (Figure 3a). Estimates of hunter effort for the zone have generally been stable during the past 10 years while estimates of kills/day have fluctuated in response to absolute harvest values (Figure 3b). Estimates of hunter effort (i.e., hunter days; Figure 3b) in this zone are not white- tailed specific and include days spent hunting mule deer, while kill data is specific to white-tailed deer, therefore kills/day estimates are biased low. Similar to ratio estimates discussed above, the low harvest and decline in kills/day in 2015 and 2016 was likely due to the 2015 drought and associated BT outbreak resulting in immediate mortalities and poor recruitment the following year. The low harvest and kills/day in 2017 is likely due to a lag effect of the BT outbreak and the hard winter of 2016-17. The continued low harvest in the zone in 2018 may be tied in part to the small EHD outbreak, however an additional variable to consider is that the 94% of this zone is private land and if private landowners are not opening their land to hunters due to perceived low white- tailed deer numbers this can have a marked effect on harvest.

The South Palouse currently comprises roughly 17% of the harvest, and although this portion of the Palouse Zone has not experienced BT to the same degree as the North Palouse, harvest changes have followed a similar pattern. However, individual GMUs show very different harvest trends; GMU 149 has showed a relatively stable harvest pattern, while harvest in GMU 145 has fluctuated widely over the past 10 to 20 years. When drought conditions occur, they are generally more severe in the eastern portion of the South Palouse, likely affecting both hemorrhagic disease outbreaks and habitat conditions that relate to overall herd health, which may be one reason we observe more variation in harvest in GMU 145.

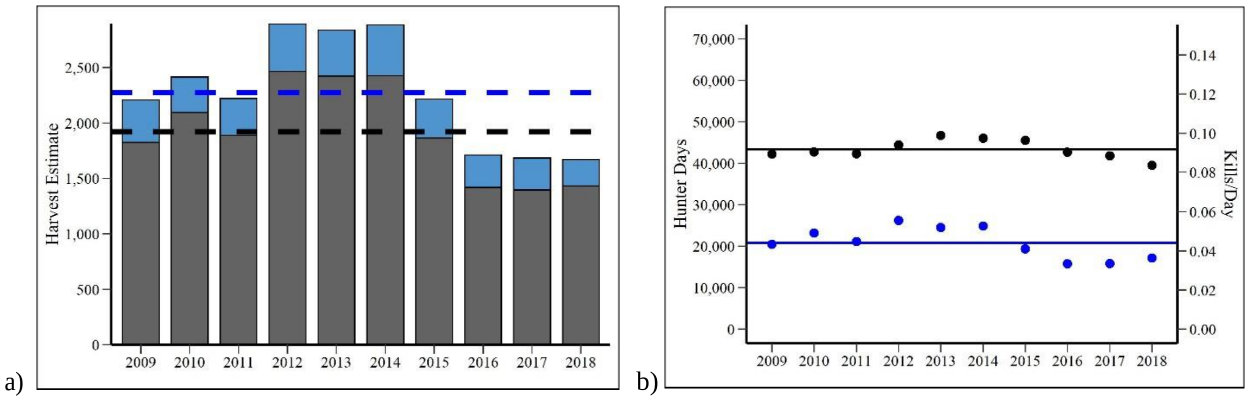


Figure 3. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray) and General + Permit State Harvest (blue); and (b) general season estimates and 10-yr mean for hunter days (black) and kills/day (blue);in the Palouse WDMZ, 2009–2018.

Survival and Mortality

No estimates of pregnancy, fetal, or survival rates are available for white-tailed deer in the Palouse WDMZ. Similar to mule deer, sources of mortality in this zone include harvest, collisions with vehicles, poaching, and predation. Predator species living within this zone include cougars, bobcats, black bears, coyotes, golden eagles, and domestic dogs.

Habitat

The Palouse WDMZ includes five broad habitat types: active agricultural fields, Conservation Reserve Program (CRP) fields (primarily grasslands), a native grass/shrub complex (primarily along the breaks of the Snake River), coniferous forest, and riparian. Locations obtained during aerial and ground surveys have shown a relationship between white-tailed deer and riparian corridors, primarily the Palouse, Spokane, Little Spokane, Touchet, Tucannon, and Walla Walla Rivers and some creeks and hollows, such as Rock, Union Flat, Meadow, and Deadman Creeks. We observed fewer white-tailed deer than mule deer along the Snake River breaks and unbroken CRP fields, and more whitetails associated with shrubby draws intermixed with active agricultural fields. Coniferous forest habitat exists primarily in the north of this WDMZ and is intensively used by white-tailed deer, especially when it is associated with agricultural fields. White-tailed deer have also taken advantage of larger acreage (10-20 acre) semi-rural development where forage and cover is present and predation risk (human and non-human) is reduced.

Human-Wildlife Interaction

High numbers of vehicle collisions with white-tailed and mule deer are a problem along State Highways 195, 26 and 2, and Interstate 90 in the North Palouse WDMZ. WDFW is working with the Washington State Department of Transportation to identify hot spots and come up with solutions.

Additionally, crop damage is reported annually in some portions of all GMUs in the North Palouse and is likely to increase as farmers switch to higher value crops like garbanzo beans. Antlerless harvest is the primary tool used to address crop damage; we apply it both at a broad (GMU-wide) scale through general season antlerless opportunity for archery, muzzleloader, youth, senior, disabled, and antlerless only permits and second deer tags (1,075 in 2018), as well as at the individual landowner scale through damage and kill permits (133 permits in 2018).

Deer crop damage complaints in the South Palouse WDMZ, as measured by damage permits issued, account for approximately 44% of the permits issued across District 3, but the majority of complaints are related to mule deer. There are isolated damage issues with white-tailed deer along the boundary of GMU 149 with GMU 154 near Walla Walla, where some orchard, vineyard, and strawberry damage is attributable to whitetails. In response to increasing damage complaints, antlerless permit numbers since 2013 have increased by 200 across both GMUs, with 45 of those permits specifically for white-tailed deer.

Management Concerns

Mass conversion of natural habitats to agriculture occurred over the past century 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, garbanzo bean, and hay prices, several landowners have chosen not to re-enroll in CRP after their contracts expired. In addition, there has been a recent reduction in funding available for CRP, and many expiring contracts have not been eligible for renewal.

Habitat loss due to development is of concern in GMUs 127 and 130, with the redistribution of Spokane's urban populations outward into rural settings. High-density development (>1 house per acre) removes less habitat than low-density development (<1 house per 10 acres) but tends to permanently displace 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.

Bluetongue (BT) and Epizootic Hemorrhagic Disease (EHD) occur in this zone and likely cause a small number of isolated mortalities every year. During droughts, these disease events can be more severe and can affect white-tailed deer herds across multiple Management Zones. This occurred in 2015 when white-tailed deer deaths related to BT were reported in the Palouse, Columbia Basin, and Selkirk WDMZs.

Management Conclusions

Based on harvest metrics and limited survey data, white-tailed deer populations in the Palouse WDMZ appear to be meeting management objective.

Literature Cited

Washington Department of Fish and Wildlife. 2010. Washington State deer management plan: white-tailed deer. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA. 124 p.

Selkirk White-tailed Deer Management Zone

MICHAEL ATAMIAN, Wildlife Biologist
ANNEMARIE PRINCE, Wildlife Biologist
CARRIE LOWE, Wildlife Biologist

Introduction

The Selkirk WDMZ is located in northeast Washington and consists of 7 Game Management Units (GMUs 105, 108, 111, 113, 117, 121, and 124; Figure 1).

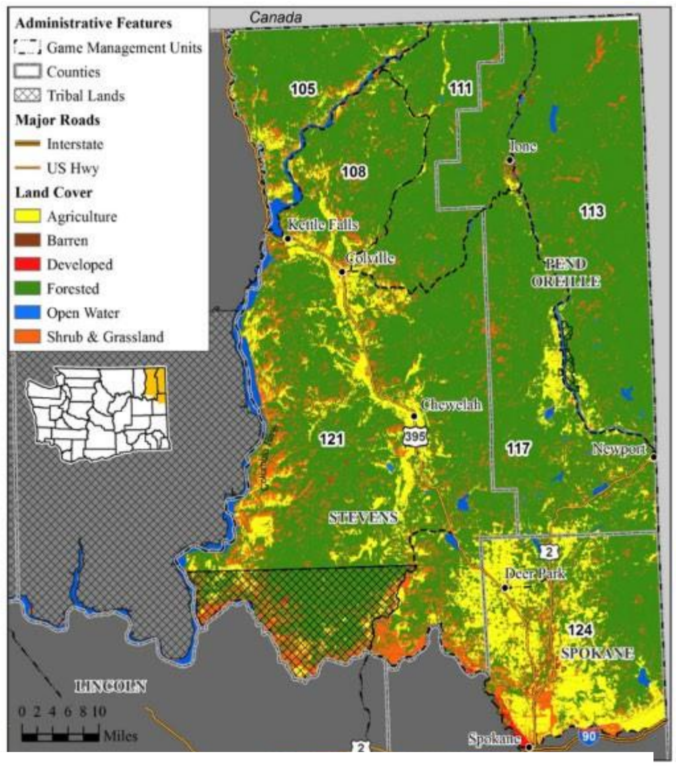


Figure 1. GMUs and generalized land cover types within the Selkirk WDMZ.

Management Guidelines and Objectives

The Department's objective within this WDMZ is to maintain a stable population based on harvest estimates and available survey data. Additional management objectives include managing for a post- hunt population with a sex ratio of 15-19 bucks:100 does (WDFW 2010).

GMUs 105 through 121 have similar rural characteristics, climatic traits, land ownership patterns, and cover types; hence management prescriptions and white-tailed deer hunting regulations are uniform throughout these 6 GMUs.

GMU 124, however, is dominated by the metropolitan area of Spokane in the south of the unit and extensive small agricultural properties in the north valleys interspersed with conifer forest in the foothills and mountains. Many of these small, private property owners do not allow hunting, thus functioning as quasi-sanctuaries. This combined with the generally milder winters in GMU 124 results in greater deer abundance than in the northern GMUs. Consequently, hunting regulations are formulated to be more liberal as a mechanism to help keep the white-tailed deer population within local landowner tolerance.

Population Surveys

To date, a reliable estimate of deer population size for this zone has been unattainable due to forest cover, deer behavior, staff availability, and funding limitations. As a result, ground surveys are conducted in the Selkirk zone to estimate age and sex ratios, which provide managers with a relative measure of the effect of harvest (bucks:100 does) and reproduction (fawns:100 does) on deer population status within the zone. These measures are used to inform management decisions each year.

The pre-hunt buck:doe ratio estimates from surveys conducted in GMUs 105-121 during the last 10 years (Figure 2) indicate no significant change since 2014. A fawn:doe ratio was not estimated in 2018.

In GMU 124, the pre-hunt buck:doe ratio estimate was 28:100 (90% CI = 21-37, *n* = 338) in 2018, right in line with the previous 10-yr average of 28:100. The fawn:doe ratio estimate was 58:100 (90% CI = 53-64, *n* = 430) in 2018, near the previous10-year average of 57:100.

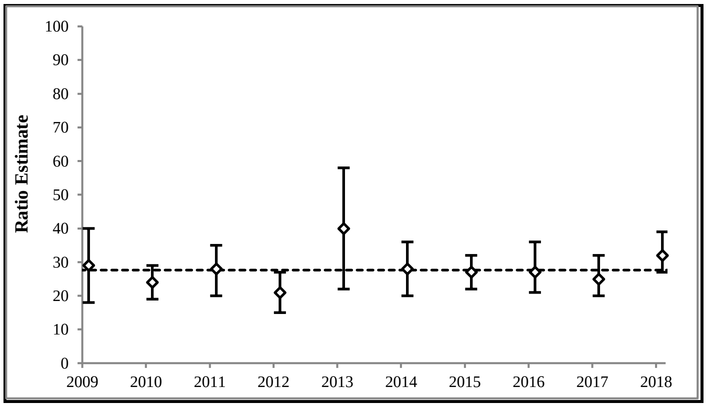
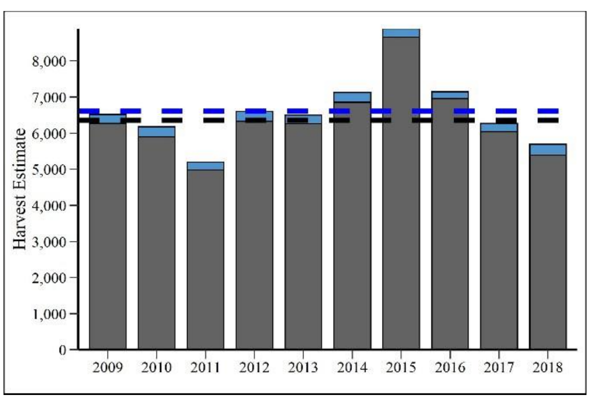


Figure 2. Estimated pre-hunt buck:doe ratios, 90% CIs, and 10-yr average (dotted line) for GMUs 105- 121 in the Selkirk WDMZ, 2009-2018.

Hunting Seasons and Recreational Harvest

Estimates of white-tailed deer harvest in this zone indicate a decline between 2008 and 2011, coincident with two consecutive harsh winters in 2008 and 2009 which suppressed fawn recruitment. In addition, there was a decline observed from 2015 to 2018, likely as a result of a wide-spread blue-tongue outbreak in 2015, followed by a severe winter in 2016/17. White-tailed deer populations generally rebound quickly from such temporary weather and disease related events, due to their naturally high reproductive potential (McCullough 1987). To support faster recovery, WDFW also reduced antlerless harvest opportunity. Estimates of harvest and kills/day (Figure 3), as well as ratio estimates from our annual ground surveys, indicate populations are not quite recovered from the most recent disease outbreak and harsh winter.



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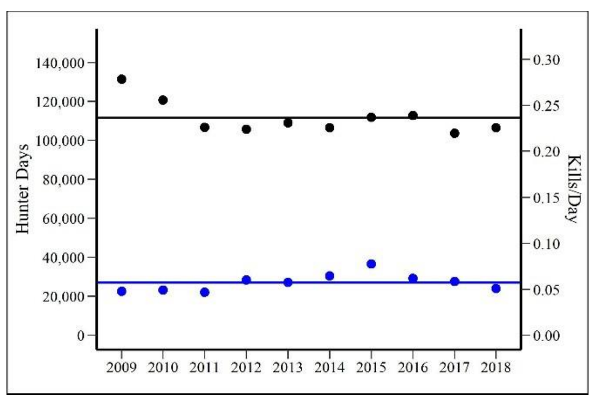

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Figure 3. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray) and General + Permit State Harvest (blue); and (b) general season estimates and 10-yr mean for hunter days (black) and kills/day (blue); in the Selkirk WDMZ, 2008–2017.

Survival and Mortality

Most recent estimates of survival for adult does in the zone were 0.87 (SD = 0.05; Henderson 2014). Mortalities documented during the study were predominantly due to cougars, domestic dogs, and deer-vehicle collisions (Henderson 2014). Other predators in this zone include black bear, grizzly bear, coyote, wolves (9 packs have been documented in this zone as of this writing [WDFW et al. 2019]), and golden eagles.

Regarding recent disease concerns in the zone, white-tailed deer populations throughout the country can be affected, to varying degrees, each fall by different hemorrhagic diseases; most often Epizootic Hemorrhagic Disease (EHD) and Bluetongue Disease. Bluetongue and EHD both naturally occur in this zone and typically cause a relatively small number of mortalities every year. During severe droughts, as happened in fall 2015, these disease events can be more pronounced and affect localized white-tailed deer herds in multiple Management Zones. Because regional weather patterns can substantially affect the scale and locality of an outbreak, incidences are neither predictable nor preventable. Though intense outbreaks, like that experienced in the Selkirk WDMZ in 2015, can be alarming, white-tailed deer appear to be well adapted to survive such ecological challenges due to high reproductive potential (McCullough 1987).

Habitat

Habitat within the Selkirk WDMZ is predominantly conifer forest, contributing approximately 68% of the total land cover within the zone. Shrub land combined with grassland, pasture, and cultivated crops make up the next highest level in land cover classes, altogether comprising nearly 21% of the Selkirk WDMZ area. These cover classes combined produce the highest densities of white-tailed deer, particularly within the farm and forest mosaic where deer have both forage and cover resources in close proximity. Although cultivated crops alone account for only 2.4% of the aforementioned land cover, their influence on support of the white-tailed deer population cannot be overstated. The Selkirk WDMZ can also be broken down to about 37% public land and 57% private lands with the remaining 6% in other categories (WDFW 2010).

Human-Wildlife Interaction

The Selkirk WDMZ is home to the largest populations of white-tailed deer in the state. Areas with large concentrations of agricultural and suburban land uses tend to attract and perpetuate greater densities of white-tailed deer than would normally occur in the wild. This interaction often leads to increased incidence of human-wildlife conflict and increased deer mortality due to vehicle collisions. A study looking at collision rates in Washington indicates that deer-vehicle collisions in this zone are consistently among the highest in the state (Myers et al. 2008). To reduce vehicle collision rates and complaints due to deer damage, the Department has worked with local landowners and county and municipal stakeholders to provide increased antlerless harvest opportunity and reduce deer densities in specific high-risk Deer Areas. In 2018, a total of 172 white-tailed deer damage prevention permits and 22 kill permits were issued to landowners experiencing issues with deer damaging their crops.

Research

Henderson (2014) examined how habitat quality influences migratory strategy of female white-tailed deer within the Selkirk WDMZ. Using GPS-collared female white-tailed deer, an evaluation was accomplished on the influence of deer access to high quality winter habitat based upon the probability of an individual migrating, the differences in seasonal habitat use between and within migratory and resident classes of deer, and the effects of this decision on the survival of female white-tailed deer. Study results found little difference between annual and seasonal rates of deer survival and that the presence of partial migration within this white-tail population may be a response to competition for high quality habitat (Henderson 2014).

Management Concerns

As less than half the land base comprising the Selkirk WDMZ is in public ownership (37%), maximizing hunting opportunities largely depends on securing access to private lands. Closely coupled to this concern is the availability of cultivated crop land cover, particularly cereal grain and alfalfa hay to the deer. Cultivated crops are a major driver to white-tailed deer density and productivity in northeastern Washington and beyond. Besides hunting, the other major sources of mortality to deer in this zone include predation by both native carnivores and domestic dogs, and road kills from collision with automobiles on public roadways. Periodically, but unpredictably, severe winter will cause major deer loss. Also unpredictable are summer heat and drought that foster conditions for severe outbreaks of hemorrhagic disease. The influence of these diverse factors can greatly complicate how best to balance deer hunting opportunity with herd sustainability.

Management Conclusions

White-tailed deer populations in this zone are considered stable and within management objectives based on harvest, survey, and survival data available for the zone.

Literature Cited

Henderson, C. R. 2014. Habitat quality influences migratory strategy of female white-tailed deer. Thesis, University of Montana, Missoula, USA.

McCullough, D. R. 1987. The theory and management of Odocoileus populations. Pages 535-549 in C. M. Wemmer, ed. Biology and Management of the Cervidae. Smithsonian Institution Press, Washington, D.C.

Myers, W. L., W. Y. Chang, S. S. Germaine, W. M. Vander Haegen, and T. E. Owens. 2008. An analysis of deer and elk-vehicle collision sites along state highways in Washington State. Completion Report. Washington Department of Fish and Wildlife. Olympia, WA. 40 p.

Washington Department of Fish and Wildlife. 2010. Washington State deer management plan: white-tailed deer. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA. 124 p.

Washington Department of Fish and Wildlife, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2017Annual Report. Washington Department of Fish and Wildlife, Wenatchee, WA, USA.

Islands Black-tailed Deer Management Zone

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Introduction

The Islands Black-tailed Deer Management Zone (BDMZ) is located in the Puget Sound in northwest Washington and consists of 11 GMUs (410-417 and 419-422; Figure 1).

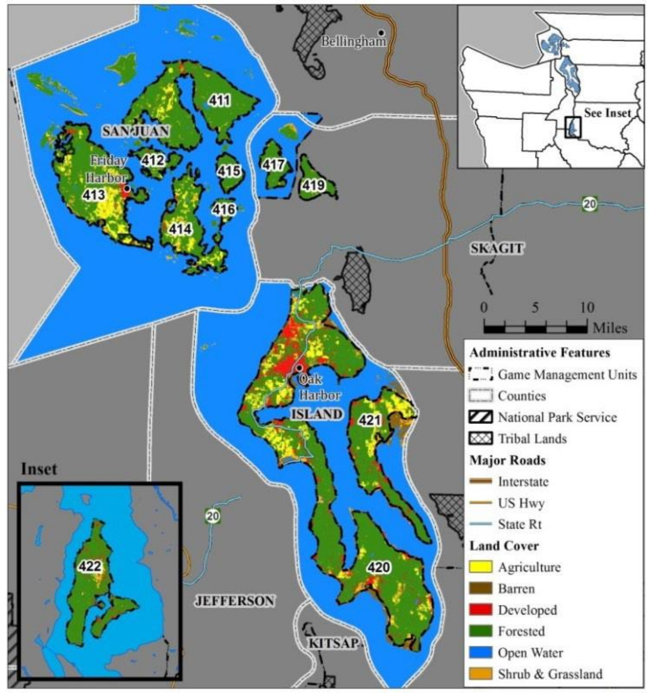


Figure 3. GMUs and generalized land cover types within the Islands BDMZ.

Management Guidelines and Objectives

The Department's objective within this BDMZ is to maintain or reduce the population based on best available knowledge for each island.

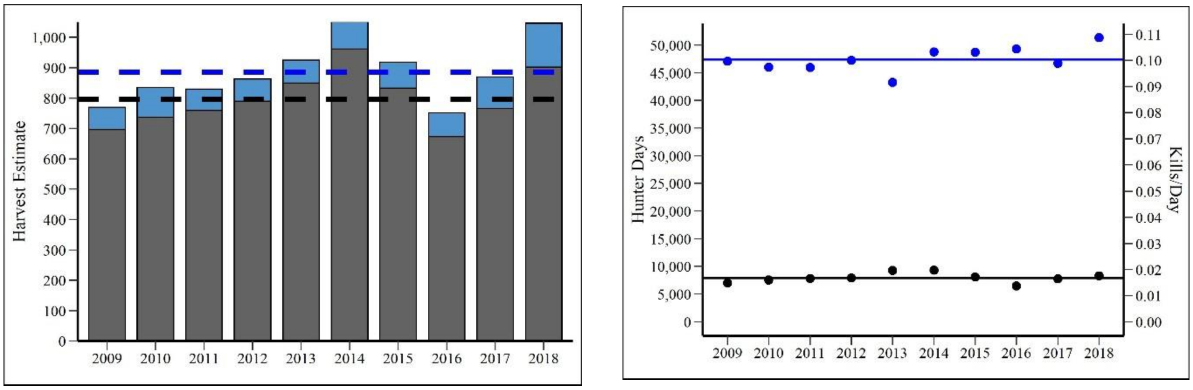
Population Surveys

There are no population surveys being conducted in the Islands BDMZ at this time. However, annual harvest estimates and anecdotal reports from island residents suggest a stable to increasing population.

Hunting Seasons and Recreational Harvest

Island BDMZ GMUs are managed for a liberal deer harvest with the intent of maintaining or reducing deer abundance. Participating hunters may harvest one animal of either sex during long general seasons. Island BDMZ general season harvest (Figure 2a) and kills/day (Figure 2b) were higher in 2018 than in recent years, although hunter participation (hunter days) was similar to the 10-year average (Figure 2b). The above-average 2018 general season harvest and kills/day stand in contrast to the below-average harvests of 2016 and 2017 and may indicate a stable to increasing population.

A total of 902 deer were harvested from the Island BDMZ during the 2018 general seasons, the majority (79%) were bucks. Modern Firearm and Multiple Weapons hunters experienced the highest success rates at 53% and 55% respectively and were more likely to harvest a buck. Archery and Muzzleloader hunters experienced slightly lower harvest rates at 37% and 39% respectively and tended to harvest fewer bucks. Most of the islands in the BDMZ offer antlerless only second tag special permits as a means to reduce deer densities and increase hunting opportunity. The number of available special permits in the BDMZ was increased in 2018 from 850 to 1,050. Of the 1,050 special permits available, 770 were awarded and claimed by applicants. More deer (144) were harvested during the 2018 antlerless special permit season than during any of the previous ten years.



a) b)

Figure 2. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray) and General + Permit State Harvest (blue); and (b) general season estimates and 10-yr mean for hunter days (black) and kills/day (blue); in the Islands BDMZ, 2009–2018.

Publicly owned land is extremely limited in the BDMZ; public landowners that allow hunting on some properties include the Washington Department of Natural Resources, Bureau of Land Management, San Juan County Land Bank, Washington Department of Fish and Wildlife, and Island County Public Works Department. WDFW is currently negotiating deer hunting access to some private properties in San Juan and Island counties. Contact information for these agencies and information regarding private land hunting opportunities in the Islands BDMZ can be found in the “2019 District 13 Hunting Prospects”, available on the WDFW website.

Survival and Mortality

No information regarding vital rates is available for black-tailed deer in the Islands BDMZ. In addition to legal hunter harvest, other potential sources of mortality include predation by coyotes on Whidbey, Camano, Cypress, Guemes and Vashon Islands (the sole large predator in this zone, but absent in the San Juan Archipelago), collisions with vehicles, and poaching.

Habitat

Habitat in the Islands BDMZ generally consists of a mosaic of alder, big-leaf maple, or second growth Douglas fir forests intermixed with openings created by small regenerating clear cuts, agricultural fields, hobby farms, and horticultural plantings associated with homes and gardens. Although small towns exist on most of the larger islands serviced by the Washington Department of Transportation (WSDOT) ferries, most of the islands retain a highly rural character that provides abundant habitat for black-tailed deer.

Human development affects the amount of habitat available for deer in the island GMUs, particularly on the larger islands where local deer populations are 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.

Human-Wildlife Interaction

Vehicle collisions are common on all the larger islands in this BDMZ. Deer may be encountered any time during the day or night and complaints from residents about deer on roadways are frequent. Tolerance for high deer populations varies among island residents. Some are anti-hunting and often feed the deer while others favor aggressive reductions in the current populations. Damage complaints regarding deer depredation on farm crops, ornamental plantings, and conifer seedlings occur sporadically throughout the Islands BDMZ. In 2018, two deer in the Islands BDMZ were harvested under permits issued to landowners experiencing agricultural damage by deer. Deer depredation has altered the understory habitat conditions and resulted in reduced diversity of avian species on many islands (Martin et al. 2013). Deer predation has also been identified as a key factor hindering the recovery of the Island Marble Butterfly on San Juan Island, where deer browse flowering plants containing butterfly eggs and larvae (Lambert 2014). Deer also browse the flowers of Golden Paint Brush on Whidbey Island prohibiting the plants from setting seed that is needed for restoration projects.

Management Concerns

In 2013, most of the islands in the BDMZ were split into individual GMUs, in an effort to better understand hunter access and harvest trends on each island where deer occur. Previously, all of the islands were lumped into one or two large GMUs. In spite of outreach efforts to educate hunters of the change, hunters continue to report their harvest using the previously assigned GMU number, thus hindering our ability to assess deer management on an island-by island basis. Although accurate reporting improves each year, erroneous GMU reporting continues, complicating harvest assessments for individual islands.

Management Conclusions

Based on our harvest data, black-tailed deer populations in the Islands BDMZ are currently at or above management objective with an increasing trend.

Literature Cited

Lambert, A.M. 2014. Island Marble Butterfly *(Euchloe ausonides insulanus*) Deer herbivory research, 2013. American Camp. San Juan Island National Historical Park, National Park Service unpublished report.

Martin, T.G, P. Arcese, P.M. Kuhnert, A.J. Gaston and J.-L Martin. 2013. Prior information reduces uncertainty about the consequences of deer overabundance on forest birds. Biological Conservation 165:10-17.

North Cascade Mountains Black-tailed Deer Management Zone

ROBERT WADDELL, Wildlife Biologist
MIKE SMITH, Wildlife Biologist

Introduction

The North Cascade Mountains Black-tailed Deer Management Zone (BDMZ) is located in northwest Washington and consists of 11 GMUs (407, 418, 426, 437, 448, 450, 454, 460, 466, 485, and 490; Figure 1).

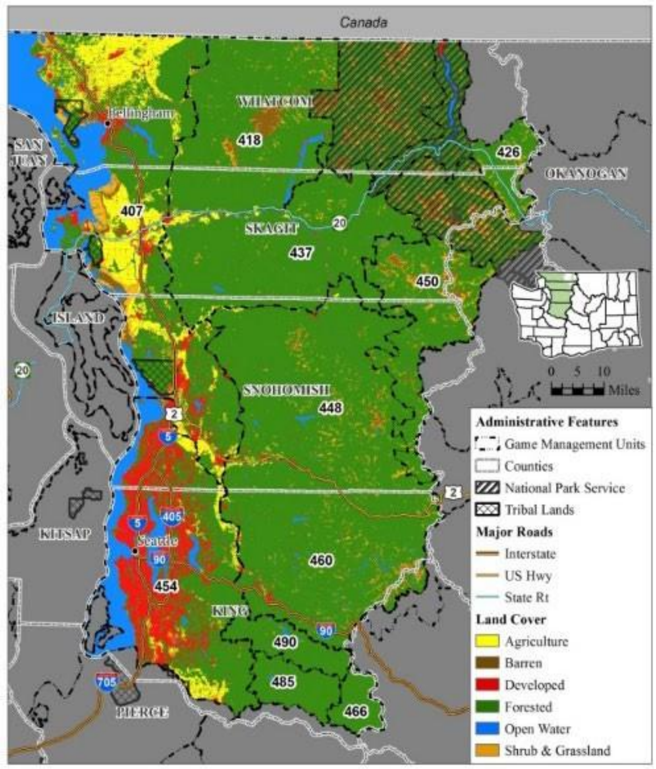


Figure 1. GMUs and generalized land cover types within the North Cascade Mountains BDMZ.

Management Guidelines and Objectives

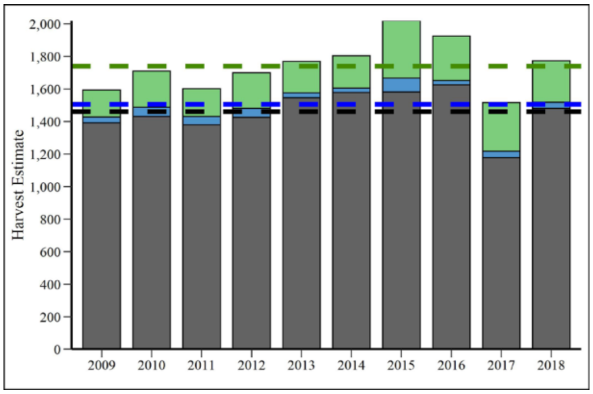
The Department's objective within this BDMZ is to maintain a stable population, based on harvest estimates and other best available information. Additional management objectives include managing for a post-hunt population with a sex ratio of approximately 15-19 bucks:100 does.

Population Surveys

Due to the difficulties of surveying black-tailed deer in the dense habitats they occupy, no formal estimates of abundance are available in this zone. However, annual harvest estimates indicate that this population is fairly stable.

Hunting Seasons and Recreational Harvest

Harvest estimates for the past 10 years generally indicate a slow rise in harvest, commensurate with increases in hunter effort in the zone (Figures 2a and 2b). The 2018 harvest estimate, including general season, special permits, and tribal harvests were just above the 10-year average (Figure 2a). The number of hunter days and kills/day were above and just below the 10-year average, respectively (Figure 2b). Overall population stability in the zone is supported by consistent long-term harvest rates (kills/day; Figure 2b).



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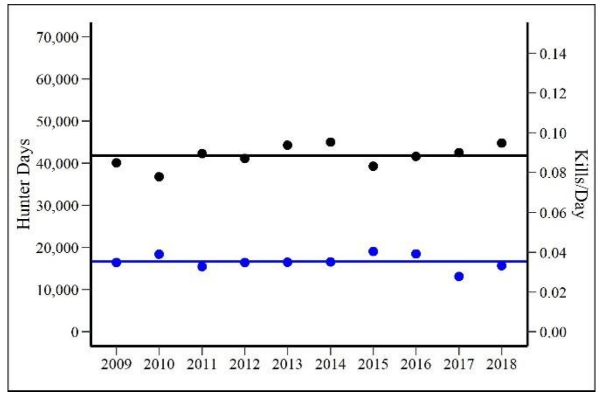

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Figure 2. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray), General State + Permit State Harvest (blue), and General + Permit + Tribal Harvest (green); and (b) general season estimates and 10-yr mean for hunter days (black) and kills/day (blue); in the North Cascade Mountains BDMZ, 2008–2018.

Survival and Mortality

No estimates of pregnancy or survival rates are available for black-tailed deer herds specific to the North Cascade Mountains BDMZ. However, vital rates of adult does are thought to be sufficient based on harvest trends. In general, estimates of annual survival of black-tailed bucks in Washington State have averaged 50 percent in forested landscapes with hunting identified as the primary source of mortality (Bender et al. 2004).

Cougars, black bears, bobcats, wolves, and coyotes occur within this BDMZ. Although the effects of predation on this population of black-tailed deer are unknown, deer harvest metrics have remained stable.

Habitat

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. Road closures continue to increase and may buffer the influences of increased human disturbance throughout deer ranges in Whatcom and Skagit counties. Increased use of herbicides on private timber lands has been observed over the last three to five years. This practice had declined on state and federally owned lands over the last ten years and was considered to be of minimal concern when compared to historical herbicide use levels. It will be necessary to monitor this activity in order to evaluate actual impacts on local deer habitats.

In general, the long-term trend in GMU 454 deer habitat is for a continued decline. This is consistent with the housing and commercial development of habitat currently used by deer. However, deer in GMU 454, and elsewhere in the North Cascade Mountains BDMZ, 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 the 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 1-10 acres exist that provide a good forage base as well as riparian corridors protected by the Washington Forest and Fish Law. 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.

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. Additional research into the relationship between current landscape conditions, herbicide application, deer populations, and habitat quality is needed. 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 recreational opportunities, fish, and wildlife.

Human-Wildlife Interaction

Deer-related damage to private property has remained a problem throughout the mainland portions of north Region Four, though no damage payments were made in this general area in 2018. Six damage permits were issued by the WDFW Conflict Specialist in Whatcom County, with no deer harvested. Permits primarily were issued on lands engaged in the production of raspberry, strawberry, and blueberries. No permits were issued in Skagit County. Five damage permits were issued in King and Snohomish Counties resulting in one harvested deer (Snohomish County). Two of these permits were focused on lands involved in the production of nursery crops and three vegetable crops. Deer Area 4541 was created in GMU 454 to offer additional opportunity and assist with damage complaints in the most densely populated portion of the unit. Thirty antlerless permits (10 each for 2nd deer, hunters 65 and over and hunters with disabilities) were offered through special application. Seven of the 30 permit recipients reported as having hunted, resulting in the reported harvest of three deer.

Management Concerns

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

Management Conclusions

Limited information is available for black-tailed deer populations in the North Cascade Mountains BDMZ but populations are considered stable based upon harvest metrics.

Literature Cited

Bender, L. C., G. A. Schirato, R. D. Spencer, K. R. McAllister, and B. L. Murphie. 2004. Survival, cause-specific mortality, and harvesting of male black-tailed deer in Washington. Journal of Wildlife Management 68:870–878.

Olympic Peninsula Black-tailed Deer Management Zone

BRYAN MURPHIE, Wildlife Biologist

Introduction

The Olympic Peninsula Black-tailed Deer Management Zone (BDMZ) is located in northwest Washington and consists of 16 Game Management Units (601, 602, 603, 607, 612, 615, 618, 621, 624, 627, 633, 636, 638, 642, 648, and 651; Figure 1).

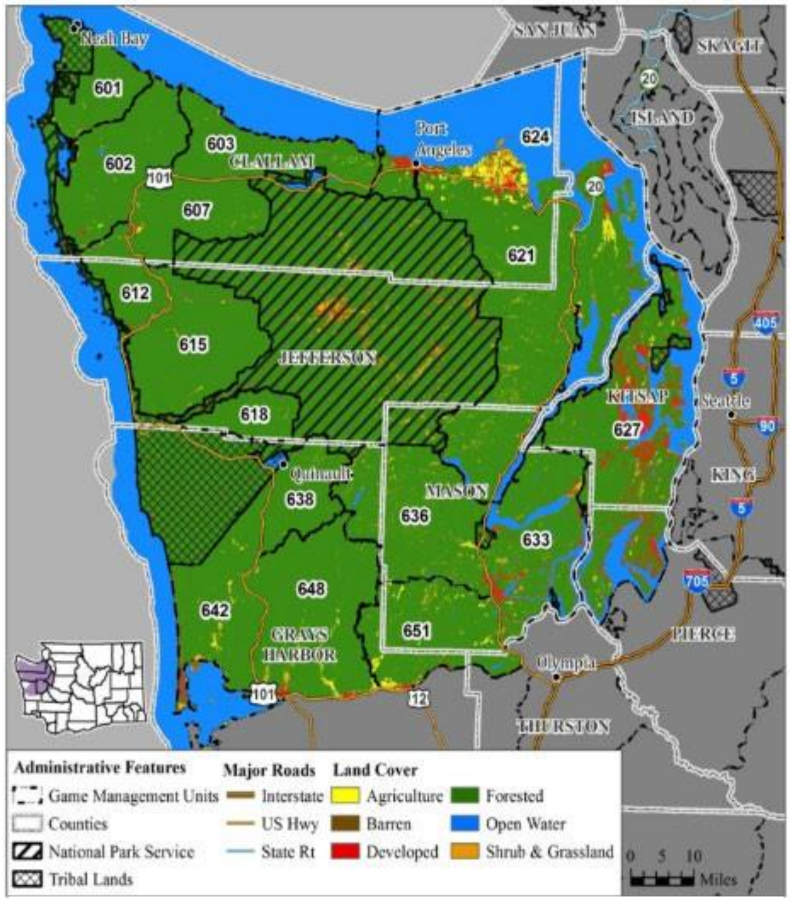


Figure 1. GMUs and generalized land cover types within the Olympic Peninsula BDMZ.

Management Guidelines and Objectives

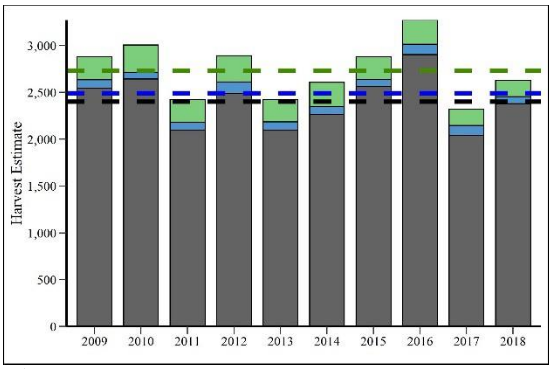
Black-tailed deer (*Odocoileus hemionus columbianus*) in this zone are managed to maintain productive populations, while providing for multiple uses; including recreational, educational, aesthetic, and a sustainable annual harvest (WDFW 2014). We attempt to achieve these objectives largely through manipulating hunting seasons. Hunting regulations for Olympic BDMZ Game Management Units (GMUs) generally provide liberal buck hunting and a conservative antlerless harvest.

Population Surveys

Monitoring is primarily achieved via mandatory hunter reporting. When funding is available, we conduct 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; 2008-2018/19). Tribal research and monitoring also provides valuable information on black-tailed deer in this BDMZ, through work conducted both independently and in cooperation with WDFW. There were no surveys conducted during this review period.

Hunting Seasons and Recreational Harvest

The 2018 deer hunting season regulations were similar to previous years in the Olympic BDMZ. Most general season hunting opportunity was any buck, while antlerless harvest was limited to certain weapon types and/or by special permit. Deer Area 6020 was open to the harvest of any deer during the general season for all weapon types. Additional hunting opportunity was provided in the Olympic BDMZ during the 2018 season with 537 special permits offered through the Department's special permit system; of these, 236 hunters reported killing 71 deer in 2018.Estimates from harvest reports indicate an increase in buck harvest (Figure 2a) and kills/day (Figure 2b) during the 2018 season, in contrast to 2017. Hunter participation was below the 10-year average, but similar to the last 5- years (Figure 2b). Tribal harvest, which accounts for 11% of the deer harvest in the Olympic BDMZ on average, was similar to 2017.



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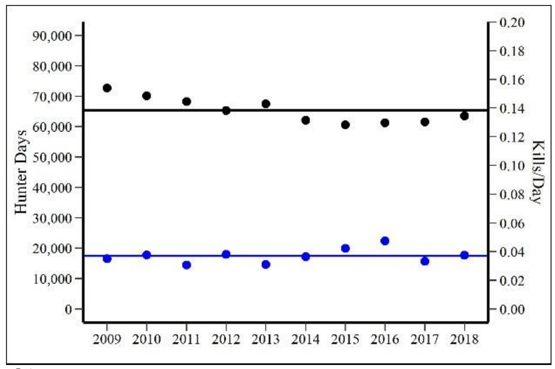


b)

Figure 2. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray), General State + Permit State Harvest (blue), and General + Permit + Tribal Harvest (green); and (b) general season estimates and 10-yr mean for hunter days (black) and kills/day (blue); in the Olympic Peninsula BDMZ, 2008–2018.

Survival and Mortality

Survival and mortality have been studied in some GMUs and inferences can be made from these data in a general sense regarding black-tailed deer in the Olympic BDMZ.

The Makah Tribe estimated adult doe survival rates in the Hoko (GMU 601) ranged from 79-87% and average annual fawn survival to be 33% (95% CI = 24-43; McCoy et al. 2014). Predation accounted for the majority of all fawn mortality in the Hoko in this study, but fawn survival was strongly influenced by the presence of hair-loss syndrome (HLS). Fawns with HLS had a lower over-winter survival probability than fawns without HLS (57% with HLS versus 80% without HLS; McCoy et al. 2014). The loss of hair directly affects their ability to maintain body temperature. They are also affected indirectly through an alteration of behavior. Afflicted deer will spend less time feeding and more time scratching or grooming (Murphie 2010). Modeling black-tail population trends assuming both with and without HLS present, indicated that HLS, coupled with predation, was likely limiting the deer population in the Hoko (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.

The Department initiated a study of the effects of forest management practices on doe survival and reproduction in 2009 (see Research section below). The field portion of the study is now complete, and data are currently being analyzed.

Habitat

Black-tailed deer in the Olympic BDMZ have access to a wide range of habitat types, from alpine meadows in the Olympic Mountains, to coastal marine estuaries along the outer coast and inland marine waters. Black-tailed deer have a selective foraging strategy preferring to consume the most nutritious plants (Nelson et al. 2008). They consume a variety of browse including woody shrubs, forbs, lichens, and some grasses. 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 that are created predominately through active logging. Units heavily logged years ago with vast areas of single-aged stands in the mid to late-seral stage of forest succession are the least productive for ungulate forage. Active timber harvest in some GMUs continues to create early seral habitat that include a diverse mix of stand-ages and provides the most benefit to black-tailed deer.

Some common plants present in black-tailed deer diets include, vine maple (*Acer circinatum*), red alder (*Alnus rubra*), cascara (*Rhamnus purshiana*), Himalayan blackberry (*Rubus discolor*), evergreen blackberry (*Rubus laciniatus*), salmonberry (*Rubus spectabilis*), trailing blackberry (*Rubus ursinus*), elderberry (*Sambucus spp.*), red huckleberry (*Vaccinium parvifolium*), fireweed (*Epilobium angustifolium*), willowherb (*Epilobium watsonii*), hairy cat's ear (*Hypocharis radicata*), big deervetch (*Lotus crassifolius*), oxalis (*Oxalis oregana*), and violets (*viola spp.*) (Nelson et al. 2008, Ulapa 2015).

Research

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.

From 2009-2017 the Department conducted a study of the effects of forest management practices on black-tailed deer doe survival and reproduction. For this study, adult female deer were captured and fitted with GPS collars to determine their habitat use and their fawns were captured and monitored for survival. This project had study sites in 8 locations in western Washington, 4 on private commercial timberlands and 4 on land managed by the Washington Department of Natural Resources. Over the course of the project, 212 does and 235 fawns were captured for monitoring. Of those, 80 does and 125 fawns were captured in GMUs 601, 621, 627, 633, and 651, within the Olympic Black-tailed Deer Management Zone. Data from this study are currently being analyzed and results are forthcoming.

Ulappa (2015) initiated a project studying how timber management practices influence the availability and quality of forage for black-tailed deer. She found that the use of herbicides reduced the amount and quality of forage available to deer during the first three years following treatment.

However, overall forage was still more abundant in these early seral stands than those 14 or more years old. Funding and in-kind contributions were provided by WDFW, the Muckleshoot Tribe, National Council for Air and Steam Improvement, and Weyerhaeuser.

WDFW has initiated a new project with the intent to generate estimates of black-tailed deer abundance or population trends at the GMU level. The field component of this effort began in May 2017 and is expected to last at least 5 years. GPS collars are being deployed on a sample of bucks distributed across western Washington with an objective of maintaining a sample of up to 50 bucks during each year of the 5-year study. Monitoring of these bucks will provide information on buck survival, causes of mortality, and vulnerability to harvest. Additionally, these collars will automatically record a position fix every thirteen hours, providing a fairly detailed account of the area used by these collared bucks.

Human-Wildlife Interaction

In the Olympic BDMZ, most of the deer conflict issues occur in urban areas where natural mortality is considered low. Management actions generally revolve around liberalizing hunting seasons or adding second deer permits in an attempt to increase harvest. These efforts often have limited value due to local shooting ordinances that can reduce deer hunting activity despite liberalized seasons. In response to damage/conflict issues, landowners can work cooperatively with WDFW through Damage Prevention Cooperative Agreements (DPCAs), which are plans designed to proactively prevent, minimize, or correct damage caused by wildlife to crops or livestock and may include both lethal and nonlethal measures.

In response to damage/conflict issues, liberal deer hunting seasons have been established in GMUs 624, 627, and 633. Forty, second-deer permits were available in the portion of GMU 624 designated as Deer Area 6020, but participation and success were quite low; 4 hunters reported harvesting 4 does. General season antlerless hunting is also provided during the general season for all three weapon types in Deer Area 6020. Although general season harvest is not reported at the Deer Area level, the combined general season antlerless harvest in GMU 624 was reported to be 31 in 2018 and the 10-year average is 58. At times, master hunters are used to help address deer conflicts. In Region 6, 20 permits were issued to master hunters in 2018; but none of these hunters reported hunting in 2018 with this permit. The Department had 9 DPCAs within the Olympic BDMZ and 15 damage prevention/kill permits were issued resulting in the removal of 8 deer.

Management Concerns

Our primary objective for black-tailed deer management in the Olympic Black-tailed Deer Management Zone is to maintain productive populations, while providing for multiple uses. 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. 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 a 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.

Management Conclusions

Based on harvest data, black-tailed deer populations in the Olympic Peninsula BDMZ are likely within management objectives, with stable populations where habitat allows.

Literature Cited

McCoy, R. H., S. L. Murphie, M. Szykman-Gunther, and B. L. Murphie. 2014. Influence of hair loss syndrome on black-tailed deer fawn survival. The Journal of Wildlife Management 78(7):1177-1188.

Murphie, S. L. 2010. Effect of hair loss syndrome on survival, behavior, and habitat-selection of black-tailed deer fawns. Thesis, Humboldt State University, Arcata, CA, USA.

Nelson, J., D. Cottam, E. W. Holman, D. J. Lancaster, S. McCorquodale, D. K. Person. 2008. Habitat guidelines for black-tailed deer: coastal rainforest ecoregion. Mule Deer Working Group, Western Association of Fish and Wildlife Agencies.

Ulappa, A. 2015. Using foraging dynamics to answer landscape management questions: the nutritional ecology of black-tailed deer. Dissertation, Washington State University, Pullman, WA, USA.

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

South Cascade Mountain Black-tailed Deer Management Zone

NICHOLLE STEPHENS, Wildlife Biologist
ERIC HOLMAN, Wildlife Biologist

Introduction

The South Cascade Mountains Black-tailed Deer Management Zone (BDMZ) is located in the southwest portion of the Cascade Mountains and consists of 22 GMUs (503, 505, 510, 513, 516, 520, 522, 524, 550, 554, 556, 560, 564, 568, 572, 574, 578, 652, 653, 654, 666, and 667; Figure 1).

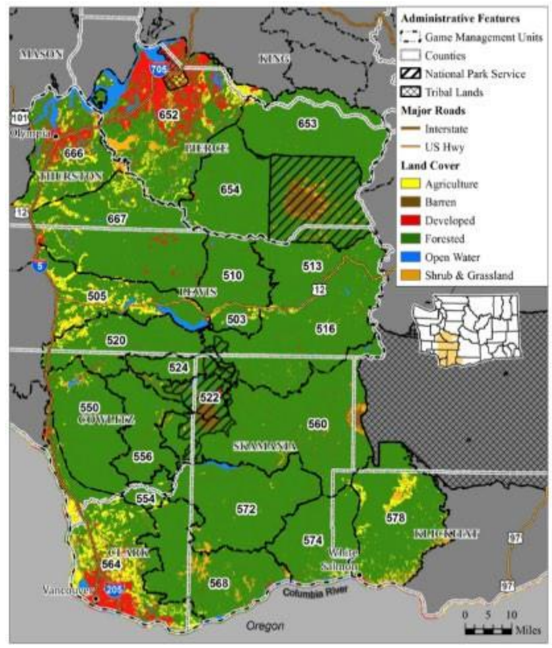


Figure 1. GMUs and generalized land cover types within the South Cascade Mountains BDMZ.

Management Guidelines and Objectives

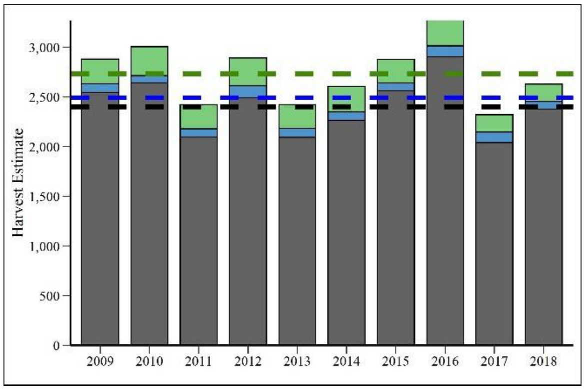
The Department's objective within this BDMZ is to maintain a stable population based on field surveys and harvest estimates and a post-hunt population with a sex ratio of approximately 15-19 bucks:100 does (WDFW 2014).

Population Surveys

Estimates of black-tailed deer abundance and post-season ratios are not available for populations within South Cascade Mountains BDMZ, but deer are generally more abundant at lower elevations in the zone.

Hunting Seasons and Recreational Harvest

Hunting seasons in the South Cascade Mountains BDMZ vary by GMU. Most hunting is structured to focus harvest on bucks and hunting is allowed on a general season basis with no antler-restrictions in place. An exception is GMU 578, which is managed with a 3-point minimum antler restriction. In many GMUs, archers are allowed to harvest antlerless deer during general seasons. Certain GMUs targeted for deer population control also allow antlerless opportunity for modern firearm under special permit drawings. Harvest estimates have remained stable over the past 10 years with 2016 seeing the highest harvest since 2007 (Figure 2a). A decrease in deer harvest during the 2017 season was observed statewide likely due in part to the severe winter of 2016-17 and drier than normal conditions during the 2017 hunting season. The 2018 hunting season saw harvests return to 10-year averages. While hunter effort has declined steadily since 2009, the catch-per-unit effort (kills/hunter-day) has increased slightly over the past 10 years (Figure 2b).



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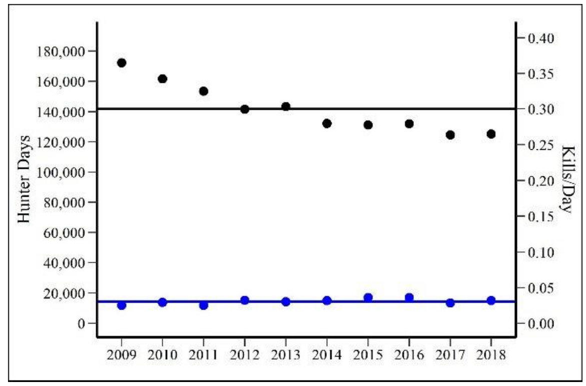

b)

Figure 2. Harvest estimates and 10-yr means (dashed lines) for General State Harvest (gray), General State + Permit State Harvest (blue), and General + Permit + Reported Tribal Harvest (green); a), and general season estimates and 10-yr mean for hunter days (black) and catch-per-unit-effort (blue); b) in the South Cascade Mountains BDMZ, 2009–2018.

Survival and Mortality

Common predator species in the South Cascade Mountains BDMZ include cougar, bobcat, black bear, and coyote. At this time there are no documented gray wolf packs in the herd area (WDFW et al. 2019).

Previous estimates of annual survival rates for black-tailed deer bucks in Washington have indicated a mean of 0.50 in forested landscapes, with mortalities primarily due to legal harvest (McCorquodale 1999, Bender et al. 2004). In more urbanized habitat, the annual buck survival rate is closer to 0.86 and mortalities are generally not the result of harvest (Bender et al. 2004). Rice (2018, unpublished report) estimated the annual survival of 188 does to be 0.77 on State Department of Natural Resources land and 0.75 on private industrial timber lands in a study area encompassing the South Cascades, Willapa Hills, and the Olympic Peninsula. McCorquodale (1999a) estimated typical doe annual survival as 0.82 in the Klickitat basin and Gilbert et al. (2007) estimated doe survival as 0.75 in commercial forest on the western slope of the Cascade Range in west-central Washington. McNay and Voller (1995) found adult doe survival on Vancouver Island to be lower for resident does (0.77) than migratory does (0.90).

Habitat

Habitat in the South Cascade Mountains BDMZ is roughly divided into thirds with U.S. Forest Service managed lands in the east; industrial and state (DNR) managed forestlands in the middle; and urban, suburban, rural, and agricultural lands in the western portion of the Zone. Increasing urbanization in the lower elevation portions of the South Cascade Mountains BDMZ has resulted in loss of quality habitat for black-tailed deer. This situation is most acute in the urbanized areas of Pierce, Thurston, and Clark counties.

The industrial forestlands consist of a mosaic of clear-cuts, relatively open young regeneration stands, dense second growth stands of timber, and stream buffers lined with second growth forest. Industrial timber management practices benefit deer by increasing the quantity of early seral habitats and the subsequent forage base. While beneficial to deer, management practices are not conducted to purposefully increase or improve habitat. Additionally, intensive forest management practices including the planting of dense stands of fast-growing conifer seedlings and the application of herbicides during re-establishment of the timber stand may also be affecting overall productivity due to reduced forage quality and availability. These effects work in tandem by reducing the amount of favorable plants available as forage in the early term and completion of forest canopy closure (typically approximately age 12), far earlier than would occur in a naturally regenerated stand. The magnitude of those effects is influenced by site-specific types of post-timber harvest treatments, plant compositions, weather, and the number of years since timber harvest. A commonality among all of these varying factors is that the best quality and most quantity of favorable forage seems to occur approximately 3 to 14 years after timber harvest whether herbicide treatments are applied or not. However, the differences between available, favorable forage in that time period for treated and untreated stands can still be substantial. A full treatise on the complexity of these habitat interactions is beyond the scope of this report and we refer the reader to Ulappa (2015) and Geary et al. (2012) for a more comprehensive understanding of this research. In contrast, very limited timber harvest on federal forests in the last three decades has led to a generally declining trend in habitat quality for deer.

Human-Wildlife Interaction

Deer damage reports occur at relatively low levels in the South Cascade Mountains BDMZ, however, complaints of damage to home gardens and ornamental plants have been increasing in parts of the South Cascades Mountains BDMZ with higher human populations. WDFW 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. In the South Cascade Mountains BDMZ in 2018-2019, there were five DPCAs in place. Two Damage Prevention Permits were issued to landowners associated with these DPCAs; however, no deer were harvested. Master hunters with damage pool permits were deployed in response to deer damage and harvested four antlerless deer. Conflict specialists and landowners use a variety of non-lethal means to discourage deer including temporary electrified fladry fencing, permanent fencing, noisemakers (bird bangers, critter gitters, and propane cannons), hazing and herding, scarecrow-like electronic devices, and odor-based repellents such as Plantskyyd. Damage on commercial agriculture production over the past year has occurred in wheat and alfalfa fields, Christmas tree farms, peach orchards, and ornamental flower 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. Master Hunters are sometimes deployed to hunt outside of established hunting seasons to directly address damage issues.

Research

From 2009-2017 the Department conducted a study of the effects of forest management practices on black-tailed deer ecology. For this study, adult female deer were captured and fitted with GPS collars to determine their habitat use and their fawns were captured and monitored for survival. This project had study sites in eight locations in western Washington, four on private commercial timberlands and four on land managed by the Washington Department of Natural Resources. Over the course of the project, 212 does and 235 fawns were captured for monitoring. Of those, 82 does and 88 fawns were captured in GMUs 550, 568, and 667, within the South Cascade Mountains Black-tailed Deer Management Zone. Data from this study are currently being analyzed and results are forthcoming.

WDFW initiated a new project in 2017 with the intent to generate estimates of black-tailed deer abundance or population trends. A subset of hunters will be asked to submit the tooth of a harvested buck to estimate the age of bucks being harvested. The field component of this effort began in May 2017 and consisted of GPS collars deployed on a sample of bucks distributed across western Washington. Monitoring of these bucks will provide information on buck survival, causes of mortality, and vulnerability to harvest. Additionally, these collars will automatically record a position fix every thirteen hours, providing a detailed account of the area used by these collared bucks.

Management Concerns

Habitat Conditions on Federally Managed Lands

Habitat conditions on federally managed lands within the South Cascades Zone are of concern. Large scale fire, timber harvest, disease, or other succession re-setting events are largely absent from the federal lands. The resulting landscape is dominated by closed-canopy forest, much of which was harvested from roughly 1950-1990 and subsequently replanted with dense Douglas fir trees. These stands provide little in the way of ungulate forage and lack the diversity and forage resources of either older or younger forests. In recent years, USFS has conducted limited forest thinning and created forest openings to provide more robust forage resources for deer and elk. While beneficial, the scale of these efforts is minimal when compared to the size of the landscape. WDFW should continue to work with USFS to encourage more of this proactive management.

Fee-Only Hunting Access Restrictions

In 2013 and 2014, the largest industrial forestland owner within the South Cascades Zone implemented a fee-only access system for hunting and other recreation on their lands. This system limits the number of individuals allowed access to these lands and has continued in the years that have followed. This has primarily affected GMUs 520, 524, 550, 556, 568, and 667. The ramifications of this limited access to deer hunting opportunity are difficult to quantify as the landowners don't own entire Game Management Units, some individuals elect to pay the access fee, some individuals elect to hunt in another area, and some may decide to quit hunting. Up to this point, the total deer harvest has remained similar, on average, in these GMUs before and after the change in recreational access opportunities. The number of hunters in these GMUs, however, has decreased by approximately one-third across the six GMUs mentioned above.

Hair Loss Syndrome

"Hair loss syndrome" (HLS) of black-tailed deer was first described in Washington in 1995. In 1996 initial reports in the South Cascades Mountains BDMZ came from GMUs 501, 504, 506, and 530. The condition is caused by a heavy infestation of a Eurasian louse of poorly defined taxonomic status in the genus *Damalinia* (*Cervicola*) sp. The normal hosts of this louse are Eurasian deer and antelope, which are not seriously affected by the lice.

When black-tailed deer become infested with this foreign louse, they tend to develop a hypersensitivity (severe allergic) reaction to the lice. The reaction 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.

Over a three-year period, Bender and Hall (2004) reported rates of "hair-slip syndrome" in fawns as 46-74% from 1999-2001. They concluded that HLS was not significant in increasing fawn winter mortality and called for future research to better determine effects HLS has on black-tailed deer populations. HLS may increase predation risk due to poor overall body condition. 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 survive 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

In addition to reports of HLS, WDFW annually receives reports of animals with hoof abnormalities, deer warts, and lethargy/unknown illness. While these afflictions can affect the behavior and survival of individual deer, they do not pose a population concern.

Management Conclusions

Harvest data indicate a stable population of black-tailed deer in the South Cascade Mountains BDMZ. However, habitat related concerns such as the lack of early seral forests on the federally managed lands and direct loss of habitat to urbanization remain a concern. The progression towards limited, fee-based hunting access programs, and hair loss syndrome also complicate deer management in the zone. Monitoring black-tailed deer populations is a perennial challenge due to the dense understory favored by deer in these landscapes, but the Department continues to investigate new methods that might provide additional information about population status in the future.

Literature Cited

Bender, L. C., G. A. Schirato, R. D. Spencer, K. R. McAllister, and B. L. Murphie. 2004. Survival, cause-specific mortality, and harvesting of male black-tailed deer in Washington. Journal of Wildlife Management 68:870–878.

Bender, L. C. and P. Briggs Hall. 2004. Winter fawn survival in black-tailed deer populations affected by hair loss syndrome. Journal of Wildlife Diseases 40(3):444-451.

Geary, A.B., J. G. Cook, R. C. Cook, and E. H. Merrill. 2012. Herbicide and Herbivory Effects on Elk Forages at Mt. St. Helens. Final research report. University of Alberta and National Council for Air and Stream Improvement. 44 pp.

Gilbert, B.A., K.J. Raedeke, J.R. Skalski, and A.B. Stringer. 2007. Black-tailed deer population dynamics modeling using structured and unstructured approaches. Journal of Wildlife Management 71:144-154.

McCorquodale, S. 1999. Movements, survival, and mortality of black-tailed deer in the Klickitat Basin of Washington. Journal of Wildlife Management 63:861–871.

McNay, R.S. and J.M. Voller. 1995. Mortality causes and survival estimates for adult female Columbian black-tailed deer. Journal of Wildlife Management 59(1):138-146.

Rice, Clifford G. 2018. Forest Management and Black-tailed Deer Reproduction. Unpublished report**.** Washington Department of Fish and Wildlife, Olympia.

Ulappa, A. 2015. Using foraging dynamics to answer landscape management questions: the nutritional ecology of black-tailed deer. Dissertation, Washington State University, Pullman, WA, USA.

Washington Department of Fish and Wildlife, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Washington Department of Fish and Wildlife, Wenatchee, WA, USA.

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

Willapa Hills Black-tailed Deer Management Zone

ANTHONY NOVACK, Wildlife Biologist

Introduction

The Willapa Hills Black-tailed Deer Management Zone (BDMZ) is located in the southwest corner of Washington and includes the southern coast of Washington. The total area consists of 12 GMUs (501, 504, 506, 530, 658, 660, 663, 672, 673, 681, 684, and 699; Figure 1).

Figure 1. GMU boundaries with county lines, and public lands within the Willapa Hills BDMZ.

Management Guidelines and Objectives

The Department's objective within this BDMZ is to maintain stable populations based on field surveys and harvest estimates. Additional management objectives include a post-hunt sex ratio of approximately 15 - 19 bucks:100 does (WDFW 2014).

Population Surveys

Conventional surveys are not possible due to the dense forest structure in this zone. Populations are currently monitored using harvest data. 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; 2009-2018).

Hunting Seasons and Recreational Harvest

Estimates from harvest reports for the past decade indicate harvest has generally been stable. The year 2017 was the lowest estimated harvest during the entire 2009-2018 timeframe (Figure 2a). Last year (2018) saw an increase in hunter harvest over 2017 but was still lower than the average since 2009.

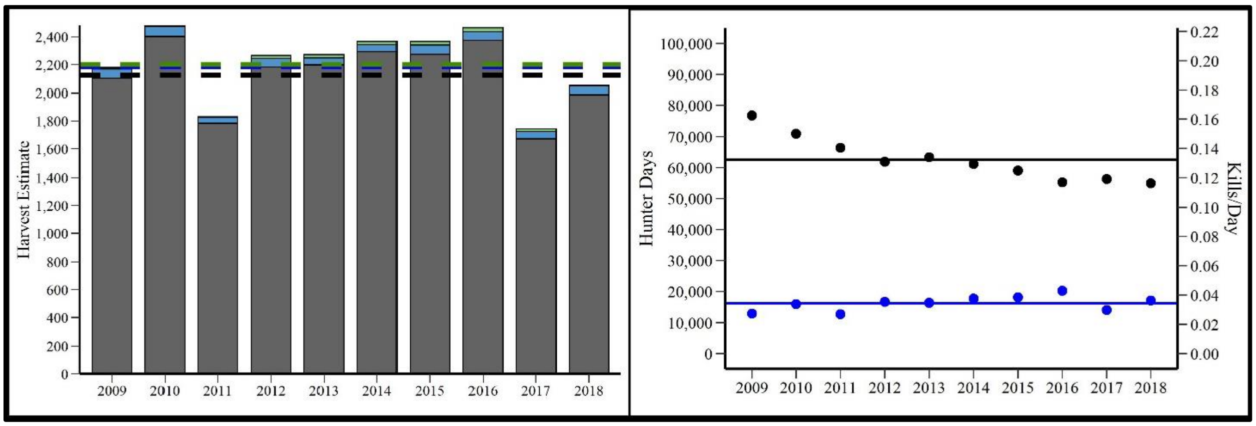

Figure 2. Harvest estimates and 10-yr means (dashed lines) for General State Harvest (gray), General State + Permit State Harvest (blue), and General + Permit + Tribal Harvest (green); a), and general season estimates and 10-yr mean for hunter days (black) and kills/day (blue); b) in the Willapa Hills BDMZ, 2008-2018.

Hunter effort has generally declined since 2009 (Figure 2b) while kills/day (e.g., Catch per Unit Effort or CPUE) had been pretty stable since 2009 and peaked in 2016. Last year (2018) recorded the third lowest rate of deer kills per day afield since 2009.

The vast majority of deer harvested in the Willapa Hills BDMZ are bucks. Any buck seasons are in effect for all GMUs open during the modern firearm seasons. The majority of GMUs are open for any buck during muzzleloader season with the exception of GMU 684 (any deer) and 699 (no muzzleloader season). The majority of units are open for any deer during archery seasons. GMUs 506, 681, and 699 are limited to any buck during archery seasons. Limited permit opportunities are available for both antlerless deer and bucks throughout the Willapa Hills BDMZ.

Survival and Mortality

No estimates of pregnancy, fetal, or survival rates are currently available for black-tailed deer in the Willapa Hills BDMZ. Sources of mortality for deer in this BDMZ include hunting, disease, malnutrition, poaching, deer-vehicle collisions, and predation. Common predator species in the Willapa Hills BDMZ include cougar, bobcat, black bear, and coyote. Previous estimates of annual survival rate for black-tailed deer bucks in western Washington revealed a mean survival rate of 0.50 in forested landscapes, with mortalities primarily due to legal harvest

(McCorquodale 1999, Bender et al. 2004). Research has concluded that will provide additional data on survival and mortality of both bucks, and female deer and fawns within the BDMZ (see Research section).

Habitat

The majority of forestland in the Willapa BDMZ is managed to maximize revenue from timber production. Both the privately-owned industrial forestlands and, a large portion of the publicly owned lands, consist of a mosaic of clear-cuts, relatively open young regeneration stands, dense second growth stands of timber, and stream buffers lined with second-growth forest. This mosaic changes on a yearly basis due to ongoing timber cutting operations. Although timber harvest is generally beneficial to deer, timber management practices are not intended to improve deer habitat.

The timber management practices implemented within the Willapa Hills BDMZ is broadly benefiting deer by increasing the quantity of early seral habitats which improves the forage base. Standard forest management practices include; planting dense stands of fast-growing conifer seedlings and, applying herbicides during re-establishment to reduce competitive plant growth. Ulappa (2015) found that herbicide use decreased the amount of understory biomass useable for foraging deer and decreased their daily digestible energy intake, especially in the first 3 years of stand establishment. Despite the widespread use of herbicide, the early seral habitats will still provide more forage and higher daily energy intake for deer than closed canopy stands. Canopy closure for intensely managed forest typically occurs at around 12 years post-planting while more naturally regenerated stands can continue to produce improved levels of forage through the first 30 years. Pre-commercial and commercial thinning of second-growth stands can greatly improve the available deer forage until canopy closure reoccurs.

Human-Wildlife Interaction

Deer conflicts with commercial agricultural activities occur at low levels in the Willapa Hills BDMZ. 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. These conflict specialists and landowners use a variety of non-lethal means to discourage deer which may include electrified fladry fencing, noisemakers, hazing and herding, scarecrow-like electronic devices, and odor-based repellents such as Plantskyyd. The total number of DPCAs relating to deer in the Willapa Hills BDMZ for 2018-2019 was sixteen with six deer harvested from 36 permits issued (Table 1). Deer within this zone primarily cause damage to commercially produced cranberries, wine grapes, blueberries, orchards, and non-commercial garden and ornamental plants.

Table 1. Sum of Deer related Damage Prevention and Control Agreements with resulting deer permits issued and total harvest by GMU in the Willapa Hills BDMZ, 2018-19.

Game Management Unit	DPCA's	Permits Issued	Deer Removed
658	9	14	3
684	7	22	3
Sum	**16**	**36**	**6**

In many circumstances, WDFW 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. Certified Master Hunters may be deployed to harvest animals outside of the regularly established hunting seasons.

Research

From 2009-2017, the Department conducted a study of black-tailed deer throughout western Washington to determine black-tailed deer fawn production and survival under a variety of forest management scenarios and conditions. Does were captured in eight different clusters across western Washington with half of those clusters predominately located on private industrial timber land, while the other half were located on Washington Department of Natural Resources (DNR) lands. Black-tailed deer does were captured in late winter or spring and fitted with GPS tracking collars and their fawns were subsequently collared shortly after birth for survival monitoring. A single cluster of does was located within the Willapa Hills BDMZ on state owned lands within Capitol Forest (GMU 663). Data from this study are still being analyzed and final results are pending.

The Department initiated a new project in 2017 with the intent to generate estimates of black-tailed deer abundance or population trends at the GMU level. The field component of this effort began in May 2017 and was expected to last at least 5 years. GPS collars were deployed on a sample of bucks distributed across western Washington with an objective of maintaining a sample of up to 50 bucks during each year of the 5-year study. Monitoring of these bucks will provide information on buck survival, causes of mortality, and vulnerability to harvest. Additionally, these collars will automatically record a position fix every thirteen hours, providing a fairly detailed account of the area used by these collared bucks. Thus far, only two collared bucks are located within the Willapa Hills BDMZ. Those two animals are specifically located inside the Fall River GMU (672).

Management Concerns

Hunter Access

WDFW actively works with timber companies to maintain hunting access. The vast majority of lands that provide deer hunting opportunities in the Willapa Hills BDMZ are privately owned industrial timberlands. There is an increasing trend among the timber companies to restrict public access or require an access permit to hunt or recreate on their lands. Implementation of fee for access programs has reduced hunter participation in the Willapa Hills BDMZ. In some instances, the number of access permits issued is lower than previous hunter participation rates. For other areas, the cost of the permit is considered too much of an added financial burden for hunters. Although the addition of access permits has caused the number of hunters to decline in some GMUs, hunter success has sometimes increased as fewer hunters are afield. Furthermore, access may also be restricted due to the risk of fire, which predominately affects early season archery and muzzleloader hunters.

Hair Loss Syndrome

"Hair loss syndrome" (HLS) of black-tailed deer was first described in Washington in 1995 and reports came from GMU's 501, 504, 506, 530, in 1996. 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.

When black-tailed deer become infested with this foreign louse, they tend to develop a hypersensitivity (severe allergic) reaction to the lice. The reaction 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.

Over a three-year period, Bender and Hall (2004) reported rates of "hair-slip syndrome" in fawns as 46-74% from 1999-2001. They concluded that HLS was not significant in increasing fawn winter mortality and called for future research to better determine effects HLS has on black-tailed deer populations. HLS may result in additive winter mortality or increase predation risk due to poor overall body condition. 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 survive 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

Management Conclusions

Black-tailed deer populations in the Willapa Hills BDMZ appear to be within management objective based on a harvest trend that indicates a stable population. Habitat conditions are expected to support a stable to increasing trend into the near future.

Literature Cited

Bender, L. C. and P. Briggs Hall. 2004. Winter fawn survival in black-tailed deer populations affected by hair loss syndrome. Journal of Wildlife Diseases 40(3):444-451.

Bender, L. C., G. A. Schirato, R. D. Spencer, K. R. McAllister, and B. L. Murphie. 2004. Survival, cause-specific mortality, and harvesting of male black-tailed deer in Washington. Journal of Wildlife Management 68:870–878.

McCorquodale, S. 1999. Movements, survival, and mortality of black-tailed deer in the Klickitat Basin of Washington. Journal of Wildlife Management 63:861–871.

Ulappa, A. 2015. Using foraging dynamics to answer landscape management questions: the nutritional ecology of black-tailed deer. Dissertation, Washington State University, Pullman, WA, USA.

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

Elk

Blue Mountains Elk Herd

PAUL WIK, Wildlife Biologist
MARK VEKASY, Wildlife Biologist

Introduction

The Blue Mountains elk herd area is located in southeast Washington and consists of 13 GMUs, including 145 (Mayview), 149 (Prescott), 154 (Blue Creek), 157 (Mill Creek Watershed), 162 (Dayton), 163 (Marengo), 166 (Tucannon), 169 (Wenaha), 172 (Mountain View), 175 (Lick Creek), 178 (Peola), 181 (Couse), and 186 (Grande Ronde) (Figure 1). The landscape is dominated by agricultural land in the prairie and foothill regions, with interspersed grassland areas and brushy draws. The most common habitat in the Blue Mountains is characterized by second growth forests consisting primarily of Ponderosa pine, Douglas fir, grand fir, and subalpine fir. The Blue Mountains have been characterized as a high plateau dissected by deep draws and canyons carved by numerous creeks and rivers.

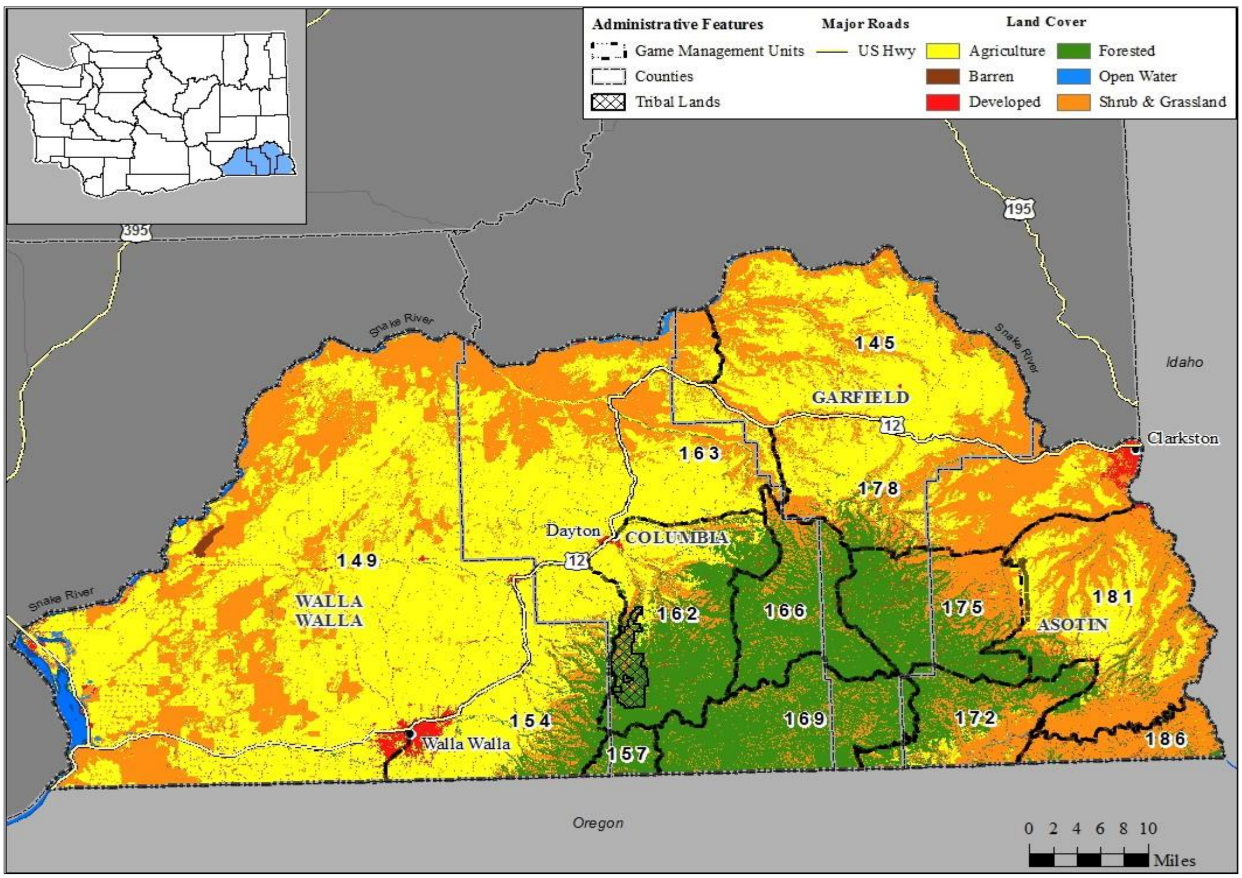

Figure 1. Dominant land use cover types within the 13 game management units that comprise the Blue Mountains elk herd area.

Management Guidelines and Objectives

The Department is currently in the process of finalizing the Blue Mountains Elk Herd Plan (last updated in 2001), which includes a population objective of maintaining herd size between 4,950 and 6,050 elk. Additional objectives include maintaining a post-hunt population with a bull:cow ratio of 22–28 bulls:100 cows and maintaining an annual survival rate of 0.50 for bulls when bull mortality is monitored (WDFW 2019).

Population Surveys

The Department monitors population status by conducting aerial surveys in the early spring and uses a sightability model developed for elk in Idaho (Unsworth et al. 1999) to generate estimates of elk abundance, age ratios, and sex ratios. In the early spring 2019, the Department estimated total elk abundance to be 4,115 elk (90% CI 3,707–4,523), which is 17% below the lower range of our management objective of 4,950 elk and 25% our point objective of 5,500 elk. Abundance estimates indicate the Blue Mountains elk herd has been within objective since 2009 but dropped substantially below in 2017 (Figure 2). The estimated bull:cow ratio in spring 2019 was 23 bulls:100 cows, which is within the management objective of 22–28 bulls:100 cows (Figure 3), although it is currently dropping. The estimated calf:cow ratio in spring 2019 was 24 calves:100 cows. Estimated calf:cow ratios were consistently near 30 calves:100 cows, 2006–2016, and dropped to one of the lowest recorded levels in 2017 (Figure 4). No aerial surveys were conducted in the Spring of 2018.

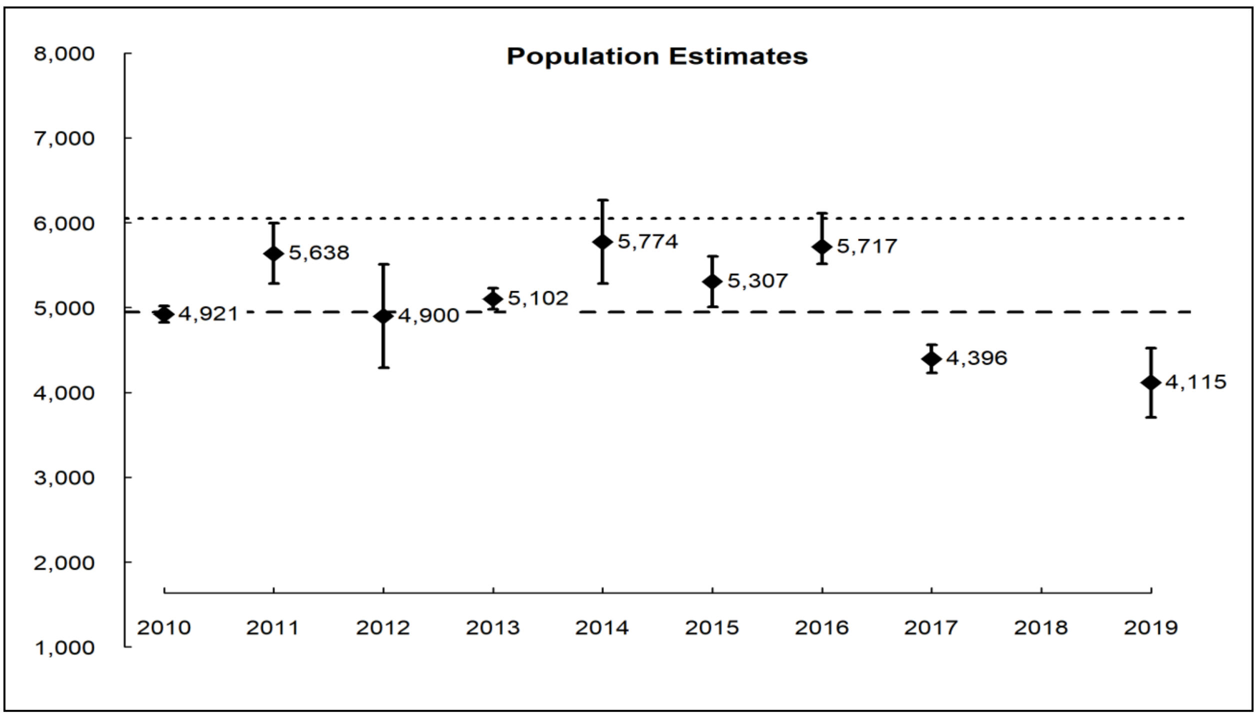

Figure 2. Sightability corrected estimates of total elk abundance with associated 90% confidence intervals in the Blue Mountains elk herd area, 2010–2019. The dashed lines represent management objectives for total elk abundance (4,950–6,050 elk).

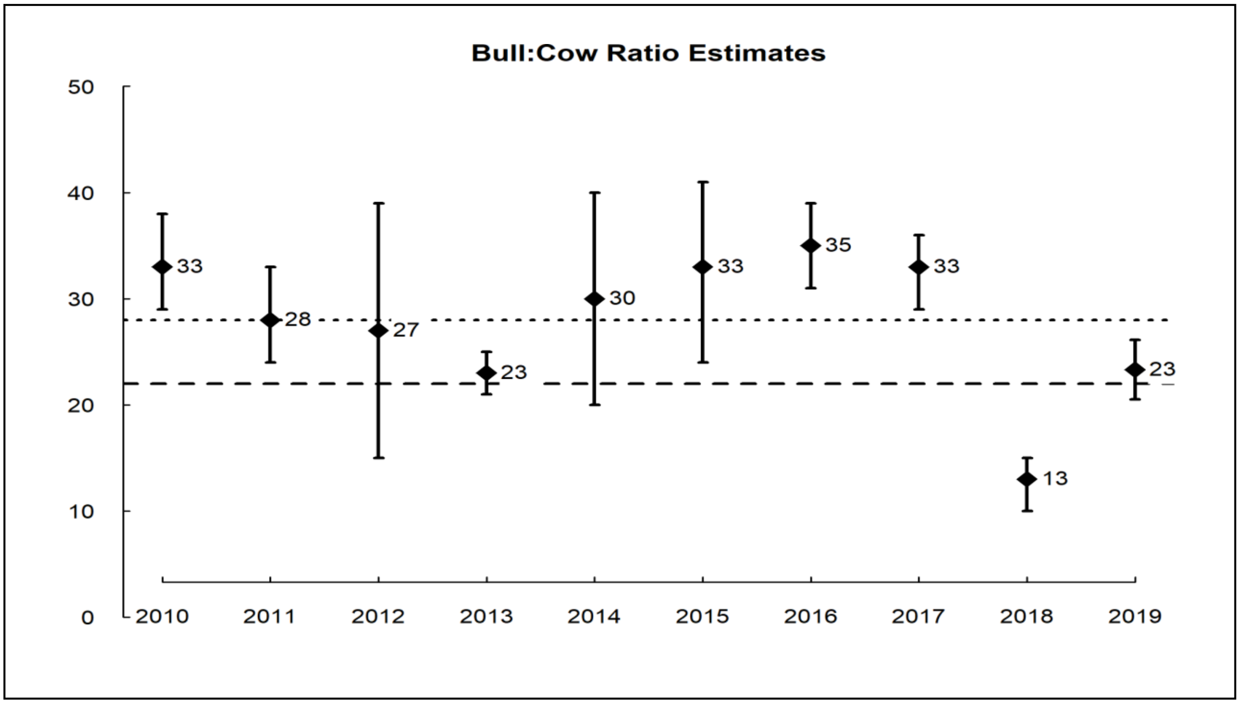

Figure 3. Estimates and associated 90% confidence intervals of post-hunt bull:cow ratios in the Blue Mountains elk herd area, spring 2010–2019. The dashed lines represent the objective range of 22-28 bulls:100 cows. 2018 data are based on ground sampling of historic elk winter ranges and are not thought to accurately reflect the true population ratios due to low observability of bulls from the ground.

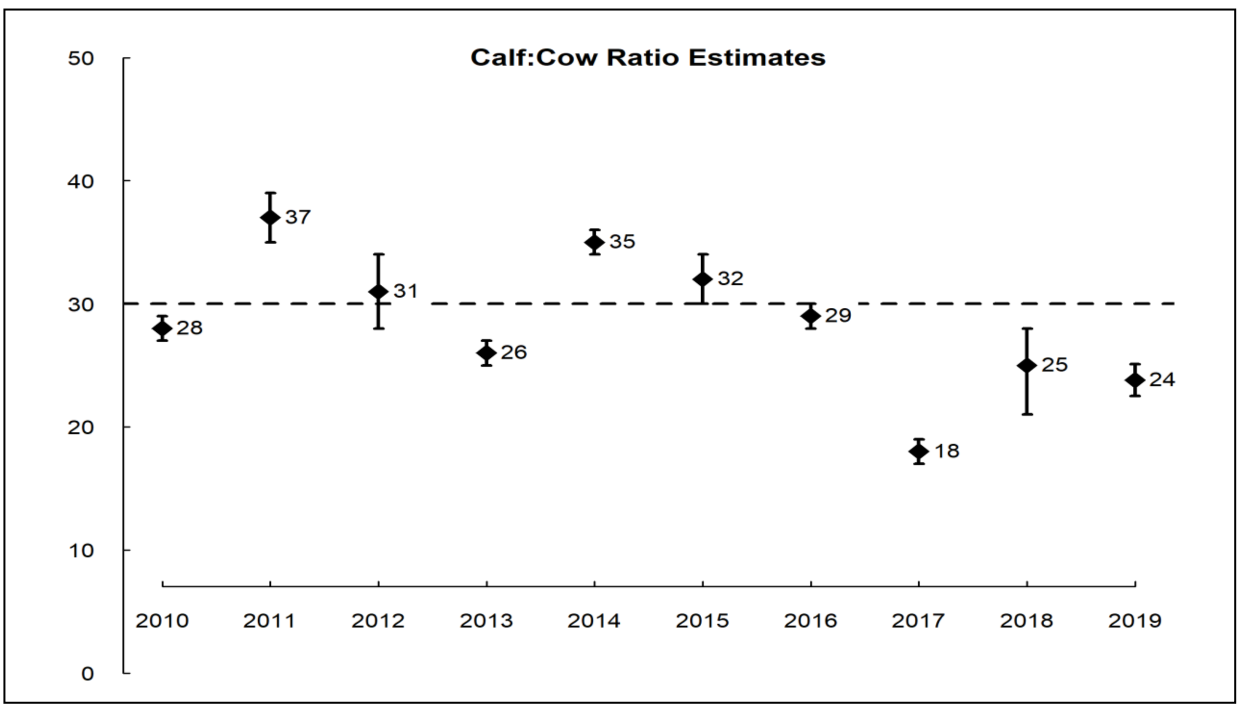

Figure 4. Estimates and associated 90% confidence intervals of post-hunt calf:cow ratios in the Blue Mountains elk herd area, spring 2010–2019. The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth. 2018 survey data are based on ground sampling of historic elk winter ranges.

Hunting Seasons and Recreational Harvest

The Department restricts general season bull harvest to spikes and offers opportunities to harvest branch-antlered bulls under special permits in all GMUs. The Department generally focuses most opportunities to harvest antlerless elk in areas associated with private land to help alleviate agricultural damage. Estimates of harvest during general seasons and total harvest have averaged 163 and 362 elk, respectively, 2009–2018, and were relatively stable 2010–2015 (Figure 5). Estimates of hunter effort during general seasons have been relatively stable since 2008 (Figure 8), while estimates of CPUE have varied, but were similar in most years (Figure 9).

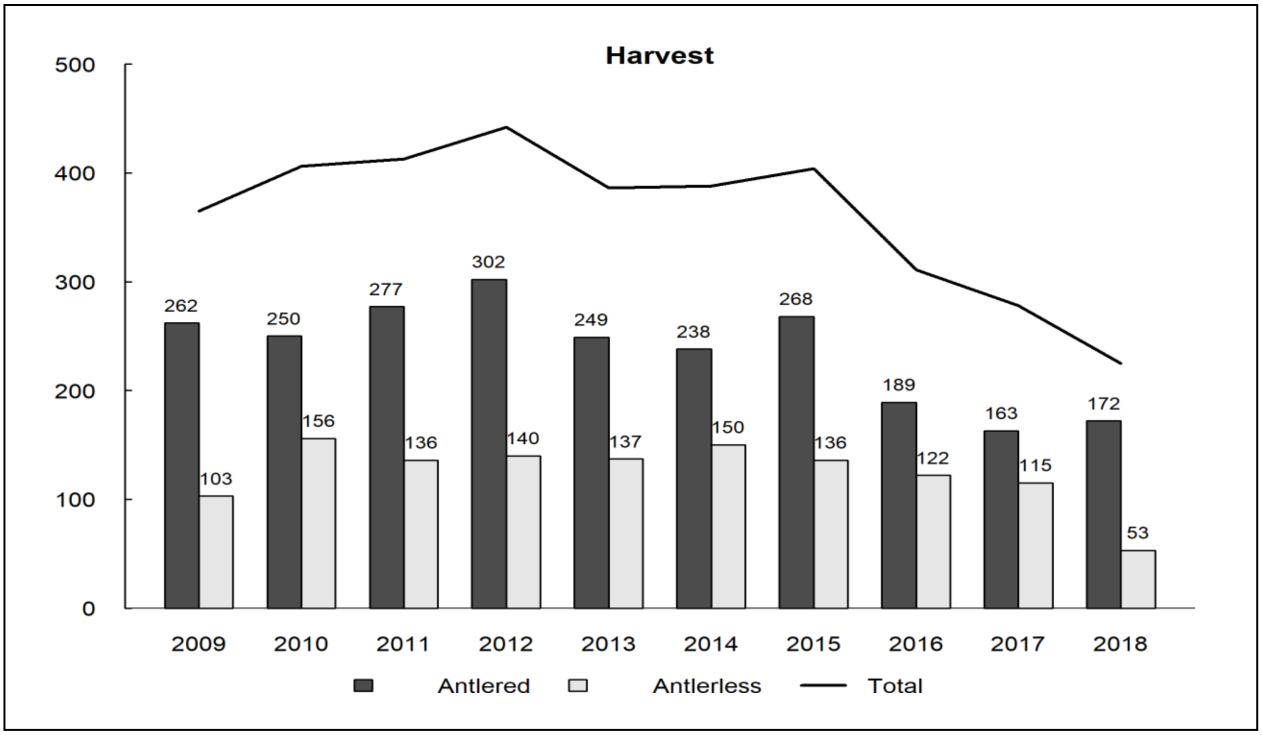

Figure 5. Estimated number of antlered and antlerless elk harvested in the Blue Mountains elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department, 2009–2018. Estimates do not include elk harvested in association with damage permits (see Human Wildlife Interaction below). Estimates also do not include harvest that occurred during established Tribal seasons because that data is not collected.

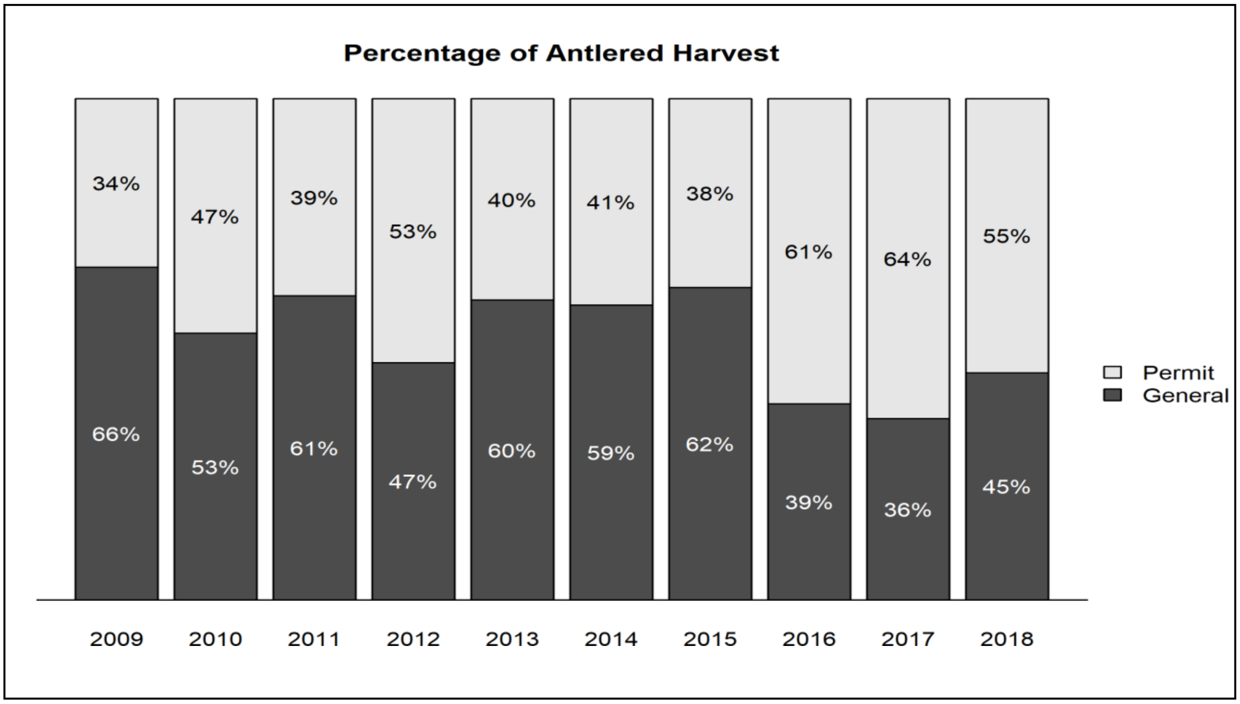

Figure 6. Estimated percentage of recreational antlered harvest in the Blue Mountains elk herd area that occurred during general and permit seasons, 2009–2018.

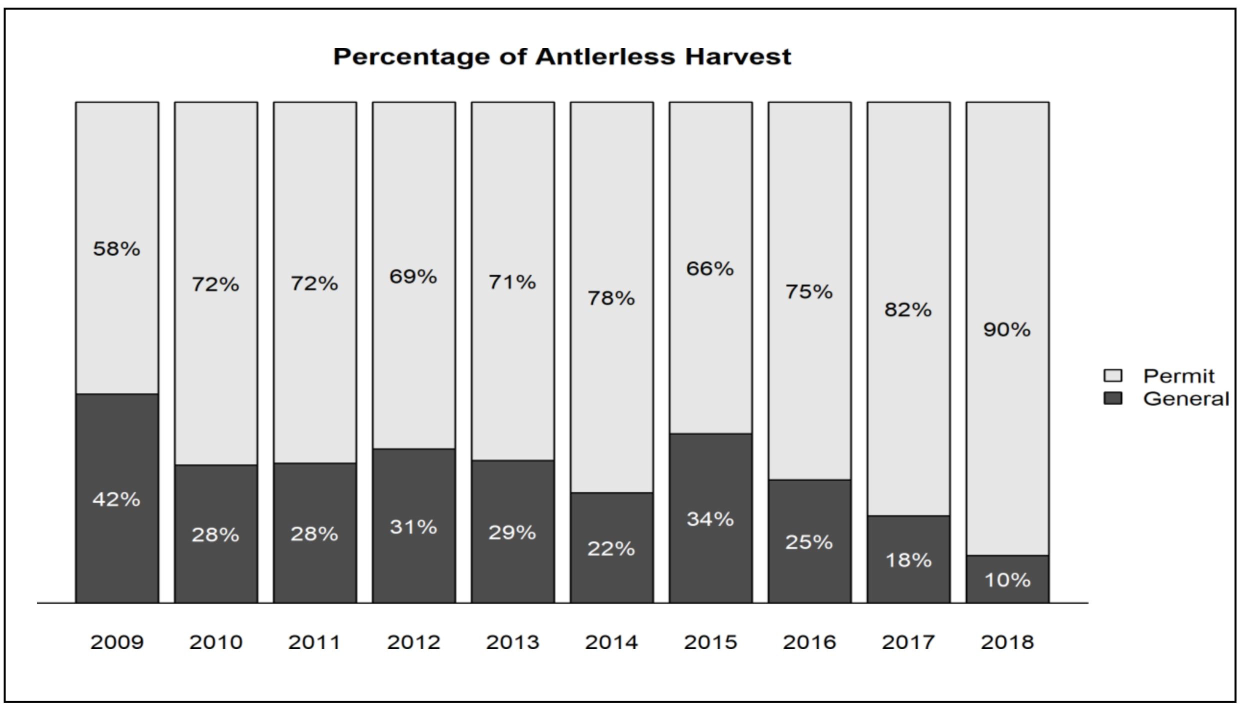

Figure 7. Estimated percentage of recreational antlerless harvest in the Blue Mountains elk herd area that occurred during general and permit seasons, 2009–2018.

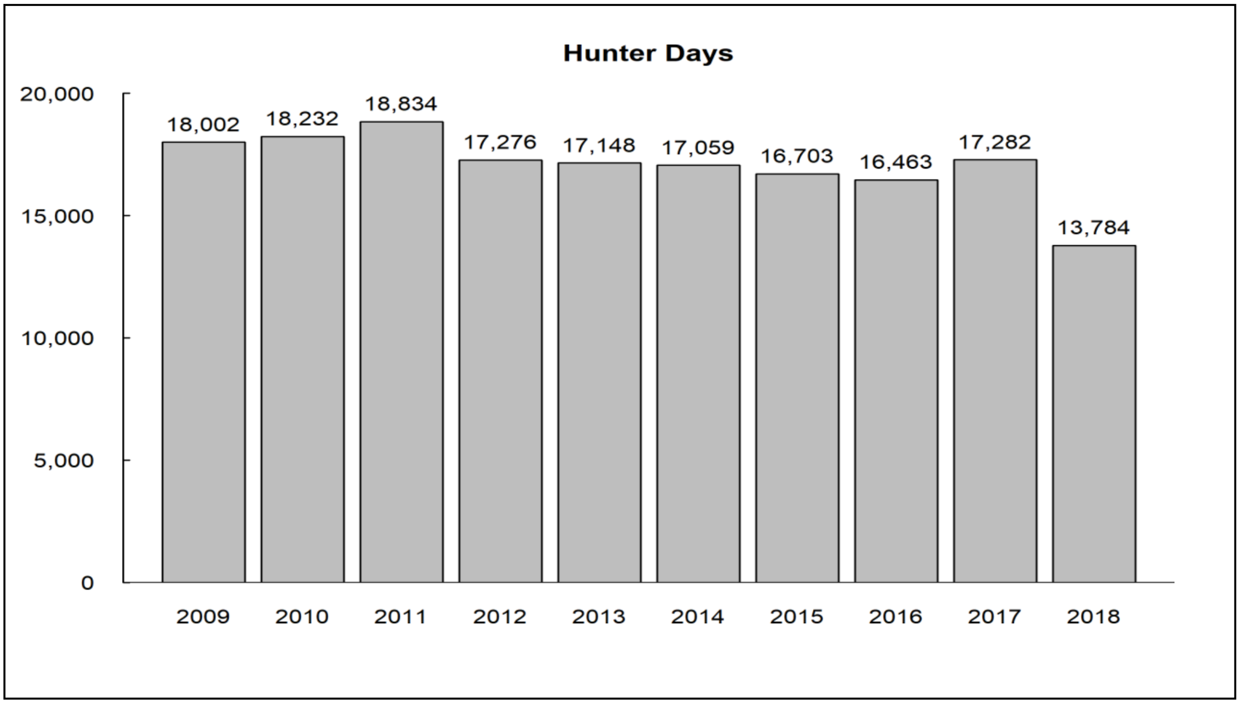

Figure 8. Estimated number of days hunters spent pursuing elk in the Blue Mountains elk herd area during recreational seasons that provided general over-the-counter opportunities, 2009–2018.

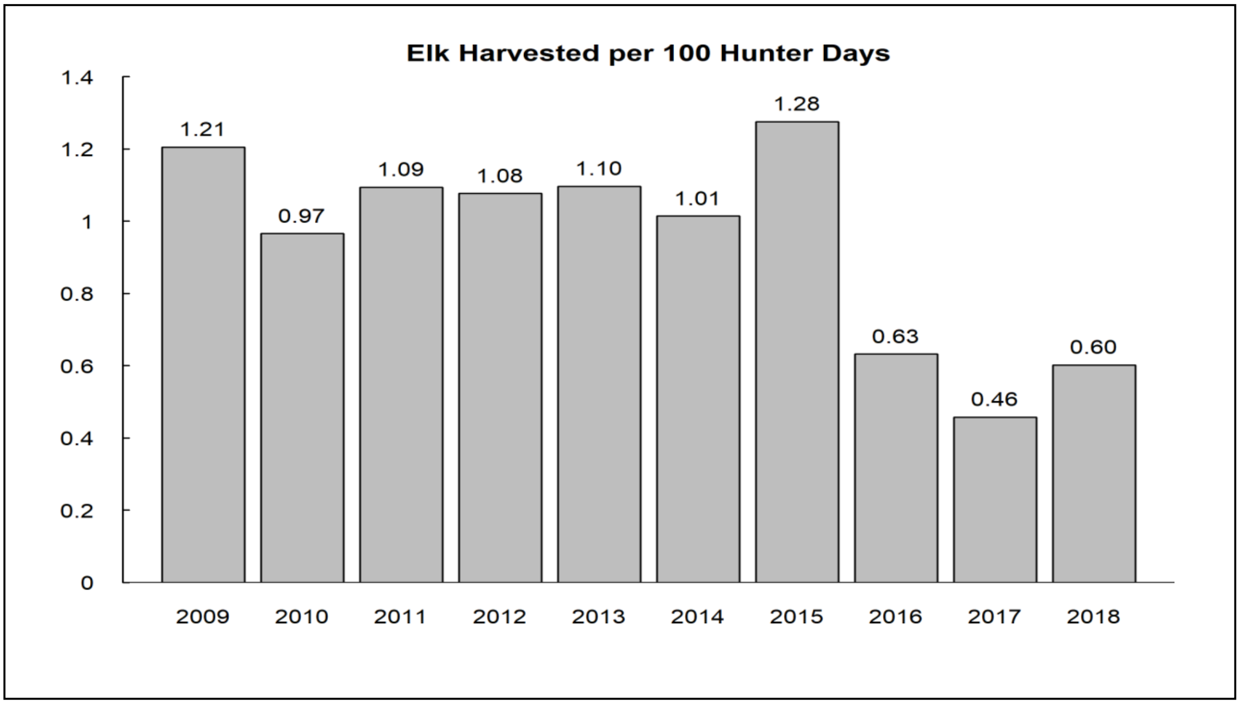

Figure 9. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the Blue Mountains elk herd area during recreational seasons that provided general over-the- counter opportunities, 2009–2018.

Survival and Mortality

Common predators of elk in the Blue Mountains include black bears, cougars, and gray wolves. Black bears and cougars occur throughout the area, but black bears are more abundant in forested areas. At the time of this writing, there are 4 confirmed wolf packs within the Blue Mountains elk herd area (WDFW et al. 2019).

Extreme weather events that strongly affect the survival of elk in the Blue Mountains elk herd area are typically rare, but extreme winter weather did occur during the 2016-2017 winter and early in 2019. Calf ratios declined dramatically as did adult survival. Dead elk were commonly reported or observed during the later portions of the winters of 2016-2017 and 2018-2019.

There are no ongoing research projects to estimate survival and cause-specific mortality rates for elk in the Blue Mountains elk herd area. The most recent elk survival study occurred 2003-2006 and we (McCorquodale et al. 2011) estimated yearling bull survival across the herd area to be 0.41 (95% C.I. = 0.29–0.53), branch-antlered bull survival to be 0.83 (95% C.I. = 0.76–0.88), and adult cow survival to be 0.80 (95% C.I. = 0.69–0.88). The leading cause of mortality for all sex and age classes monitored was associated with human harvest.

Human-Wildlife Interaction

While actual elk damage claims are low, complaints from farmers are very common and elk damage continues to be a problem in some units. This is largely being addressed by issuance of landowner depredation permits. The largest damage issues occur in GMU-154 Blue Creek, GMU-162 Dayton, GMU-178 Peola, and GMU-181 Couse. Damage tags are typically valid from July 1 – March 31, with restrictions on the harvest of antlered elk.

Damage issues in GMU-181 have remained high in the Cloverland area. Periodically, high numbers of elk move into the western portion of the unit (Couse), with this trend remaining over the past 4 years. During the reporting period, 199 Kill permits and 29 DPCA permits were issued within the Blue Mountains elk herd area. From these, approximately 14 elk were harvested with Kill Permits and 5 with DPCA, although only 6 of the 29 DPCA permit holders reported. This approach to reducing the damage elk cause private landowners is currently accomplishing its goal in a majority of the herd range. This results in more targeted hunts that directly alter elk distribution at the smaller scale.

Research

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

Management Concerns

The number of elk estimated to be within the Blue Mountains herd area is 17% below the lower range of our population objective of 4,950 elk and 25% below our point objective of 5,500 elk. The decline in this population has occurred in the last 3 years and is likely attributed to summer droughts, severe winter conditions, and poor recruitment. The Department has already allocated funds to conduct a survey to estimate population estimates in March of 2020, which would have been a "skip" year if the population was within the range defined in the herd management plan. A number of management actions are being considered for implementation if the population continues to decline or remains below objective.

Road densities in some portions of the Blue Mountains elk herd area are above recommended levels and have the potential to reduce use of important summer range because of human disturbance. The USFS has closed several old roads and reduced overall road densities, but more work is needed to address elk habitat and security needs. In addition, anecdotal evidence suggests elk habitat use in early spring has changed in some portions of the Blue Mountains elk herd area due to disturbance caused by people looking for shed antlers.

Shed antler hunting and other activities on traditional winter range continues to be a concern in the Blue Mountains because these activities put elk under stress at a critical time of year. Shed antler hunting activity in GMUs 154, 162, 166, 169, 172, and 175 can be extremely intense during March and April and disturbance associated with these activities has changed elk use patterns in these areas. Bull groups are broken and scattered into the upper elevation timber and snow, while cow/calf groups can be redistributed onto agricultural lands. Closures to human use were enacted during the later portions of the 2018/2019 winter on WDFW controlled lands to reduce disturbance to elk during abnormally severe winter conditions. Closures similar in nature will be discussed as needed in the future.

Literature Cited

McCorquodale, S. M., P. A. Wik, and P. E. Fowler. 2011. Elk survival and mortality causes in the Blue Mountains of Washington. Journal of Wildlife Management 75:897–904.

Unsworth, J. W., F. A. Leban, E. O. Garton, D. J. Leptich, and P. Zager. 1999. Aerial Survey: User's Manual. Electronic Edition. Idaho Department of Fish and Game, Boise, Idaho, USA.

Washington Department of Fish and Wildlife. 2001. Blue Mountains Elk Herd Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA.

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

Washington Department of Fish and Wildlife, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Washington Department of Fish and Wildlife, Wenatchee, WA, USA.

Colockum Elk Herd

JEFFERY A. BERNATOWICZ, Wildlife Biologist

Introduction

The Colockum elk herd area is located in central Washington along the eastern foothills of the Cascades and consists of 6 GMUs, which include 249 (Alpine), 251 (Mission), 328 (Naneum), 329 (Quilomene), 330 (West Bar), 334 (Ellensburg), and 335 (Teanaway) (Figure 1).

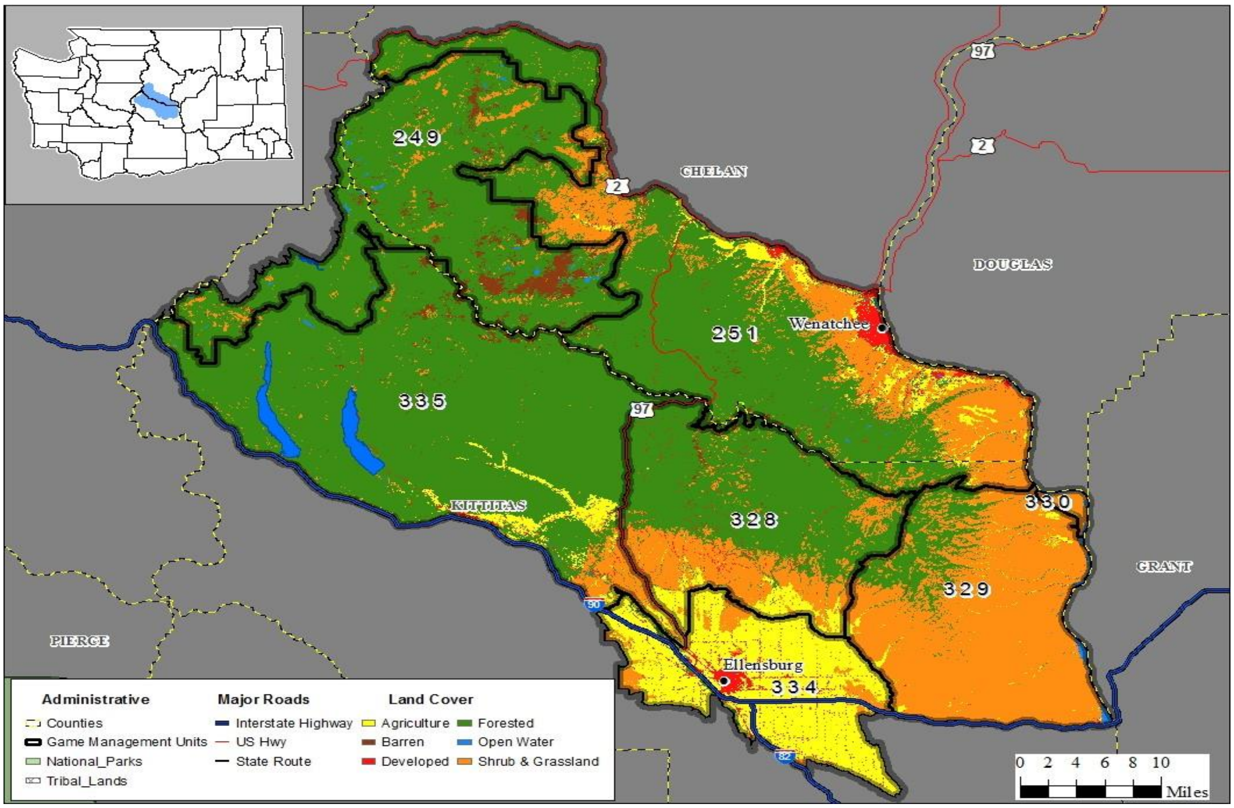

Figure 1. Dominant land use cover types within the 6 game management units that comprise the Colockum elk herd area.

Management Guidelines and Objectives

The Department's current objective is to maintain elk abundance in the surveyed winter range during spring between 4,275 and 4,725 elk (i.e., 4,500 ± 5%; WDFW 2006). Additional objectives include maintaining a post-hunt population with a bull:cow ratio of 12–20 bulls:100 cows and maintaining an annual survival rate of 0.50 for bulls if bull mortality is monitored (WDFW 2014).

Population Surveys

The Department monitors population status for Colockum elk by conducting aerial composition surveys in the spring and uses a sightability correction model developed for elk in Idaho (Unsworth et al. 1999) to estimate elk abundance, age ratios, and sex ratios in a large surveyed area of core winter range. The Department conducted post-hunt composition surveys in March 2019 and estimated total elk abundance on core winter range to be 4,133 elk (90% CI = 4,115–4,196), which is below the management objective. Estimates of total elk abundance steadily increased 2006– 2015 but have declined the last 4 years (Figure 2). Recently observed declines are a result of recent high antlerless harvest, an extended drought in 2015, and severe winter conditions during the winters of 2015-2016 and 2016-2017. With the herd now below the Department's established management objective, opportunities to harvest antlerless elk will need to be reduced.

The Department estimated post-hunt calf:cow and bull:cow ratios in March 2019 to be 25:100 and 14:100 , respectively (Figures 3, 4).

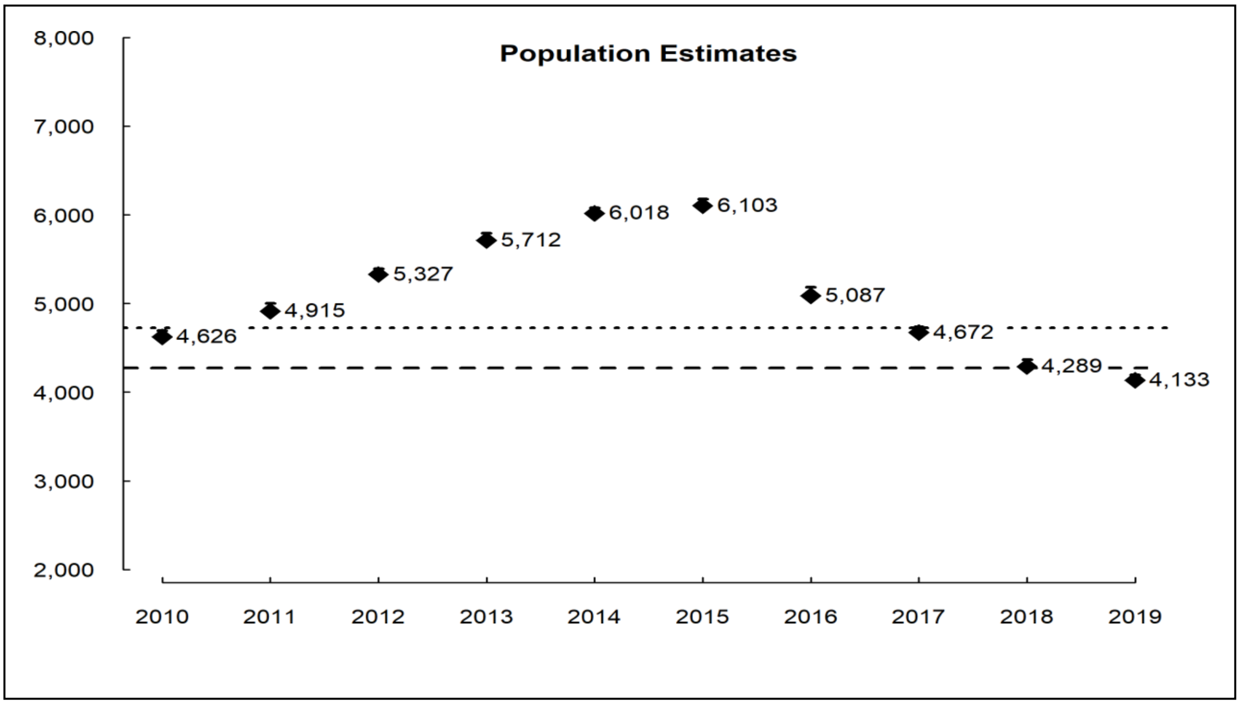

Figure 2. Sightability corrected estimates of total elk abundance with associated 90% confidence intervals in the Colockum elk herd area, spring 2010–2019. The dashed lines represent management objectives for total elk abundance (4,275–4,725 elk).

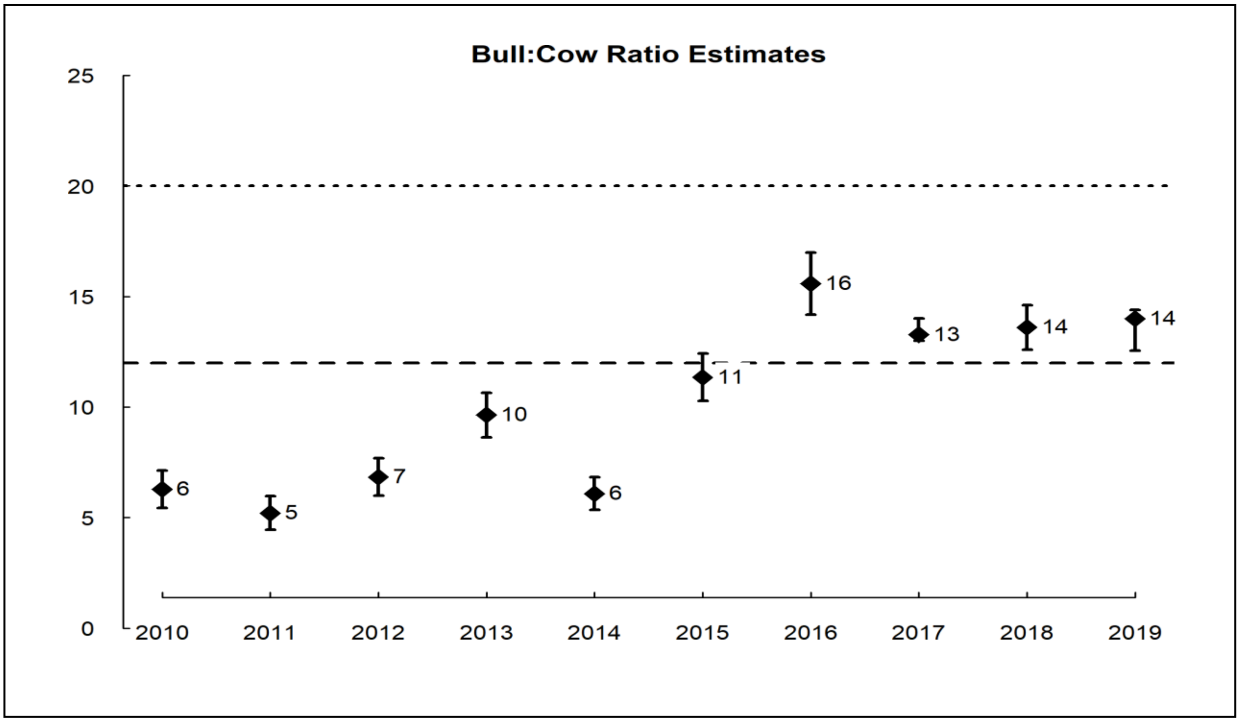

Figure 3. Estimates and associated 90% confidence intervals of post-hunt bull:cow ratios in the Colockum elk herd area, spring 2010–2019. The dashed lines represent the objective range of 12-20 bulls:100 cows.

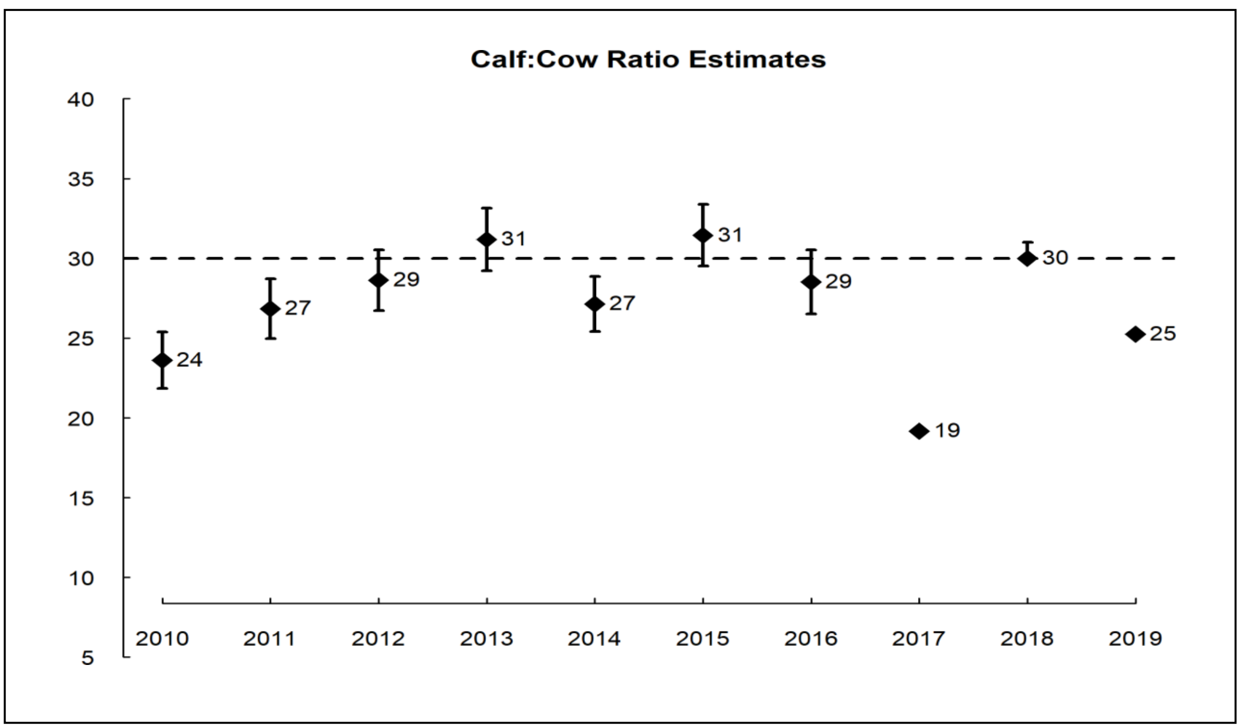

Figure 4. Estimates and associated 90% confidence intervals of post-hunt calf:cow ratios in the Colockum elk herd area, spring 2010–2019. The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth.

Hunting Seasons and Recreational Harvest

The Department restricts general season bull harvest to true-spike bulls (1×1 bulls) in the Colockum and offers opportunities to harvest branch-antlered bulls under special permits. In 2012, the Department began to increase opportunities to harvest antlerless elk throughout the herd area to bring the herd within the established management objective, and antlerless harvest steadily increased as a result before peaking in 2015 (Figure 5). As the population approached objective (Figure 2), the Department subsequently reduced those opportunities, and antlerless harvest has declined accordingly, 2016–2018 (Figure 5). Proportions of antlered and antlerless harvest during general and special permit seasons are shown in Figures 6 and 7. Hunter effort declined in 2010, likely in response to the Department implementing "true-spike" restrictions in 2009, but increased 2012–2018 as opportunities to harvest antlerless elk were increased (Figure 8). Hunter kills per 100 days of effort are shown in Figure 9.

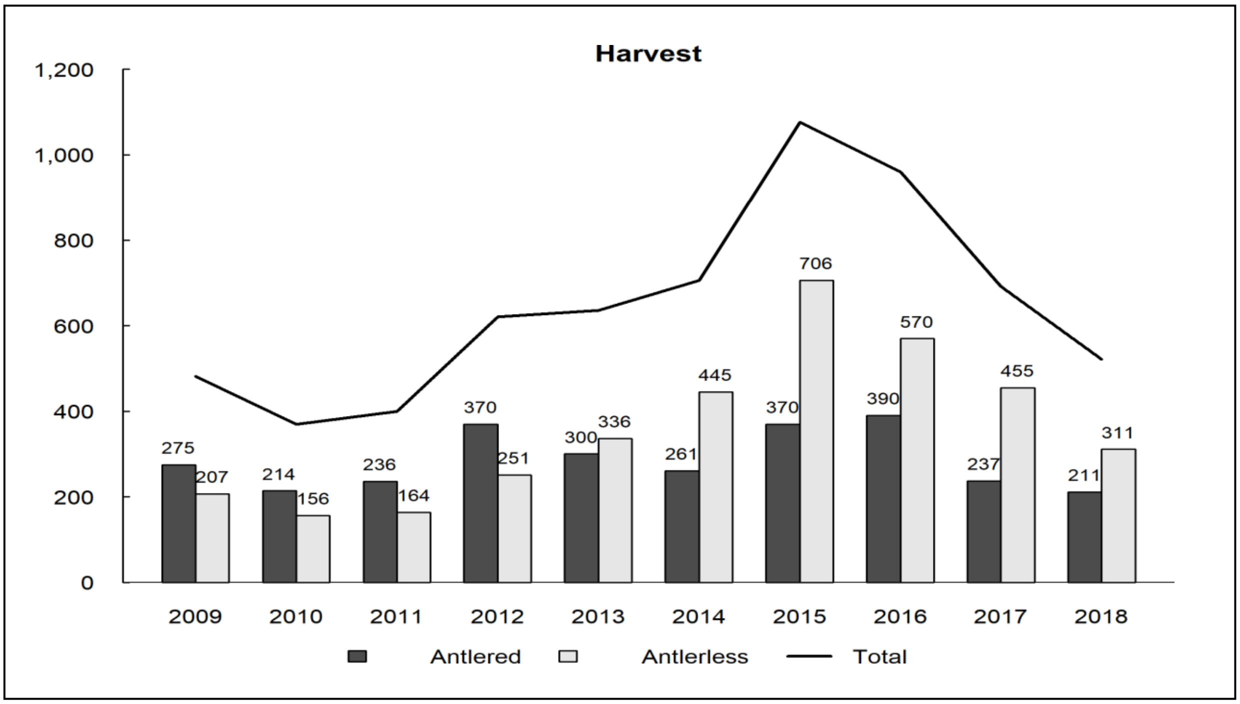

Figure 5. Estimated number of antlered and antlerless elk harvested in the Colockum elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department, 2009–2018. Estimates do not include elk harvested in association with damage permits (see Human Wildlife Interaction below). Estimates also do not include harvest that occurred during Tribal seasons because those data are currently not provided.

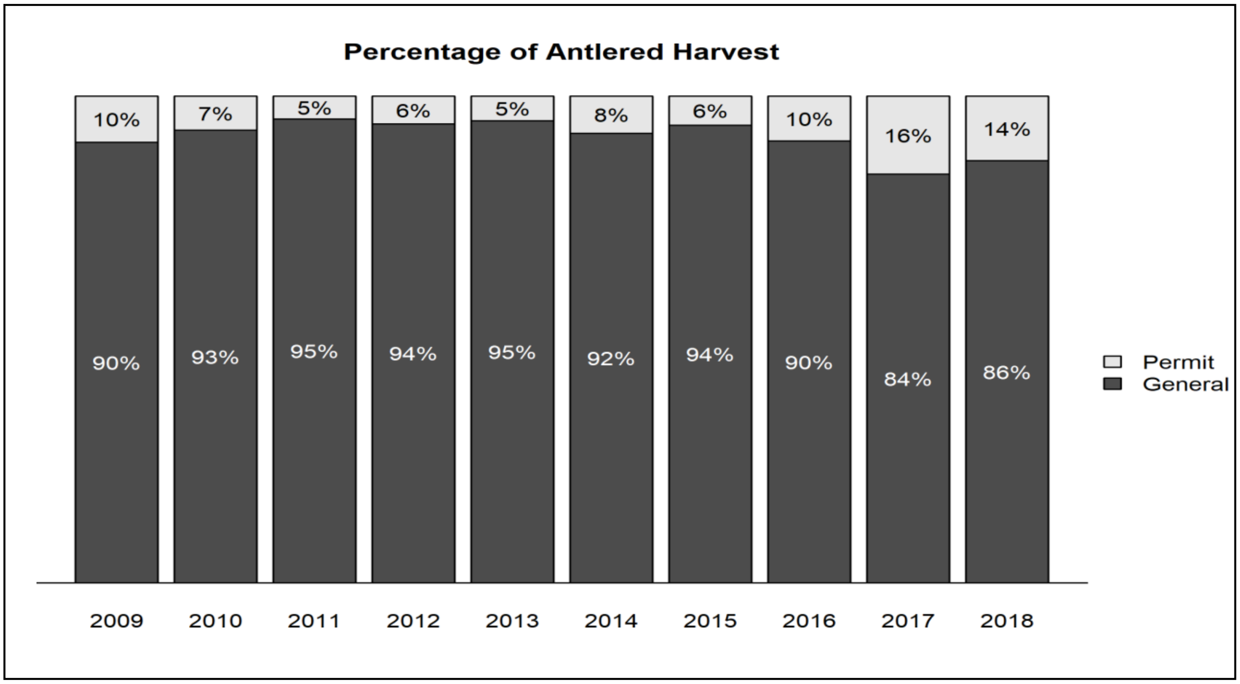

Figure 6. Estimated percentage of recreational antlered harvest in the Colockum elk herd area that occurred during general and permit seasons, 2009–2018.

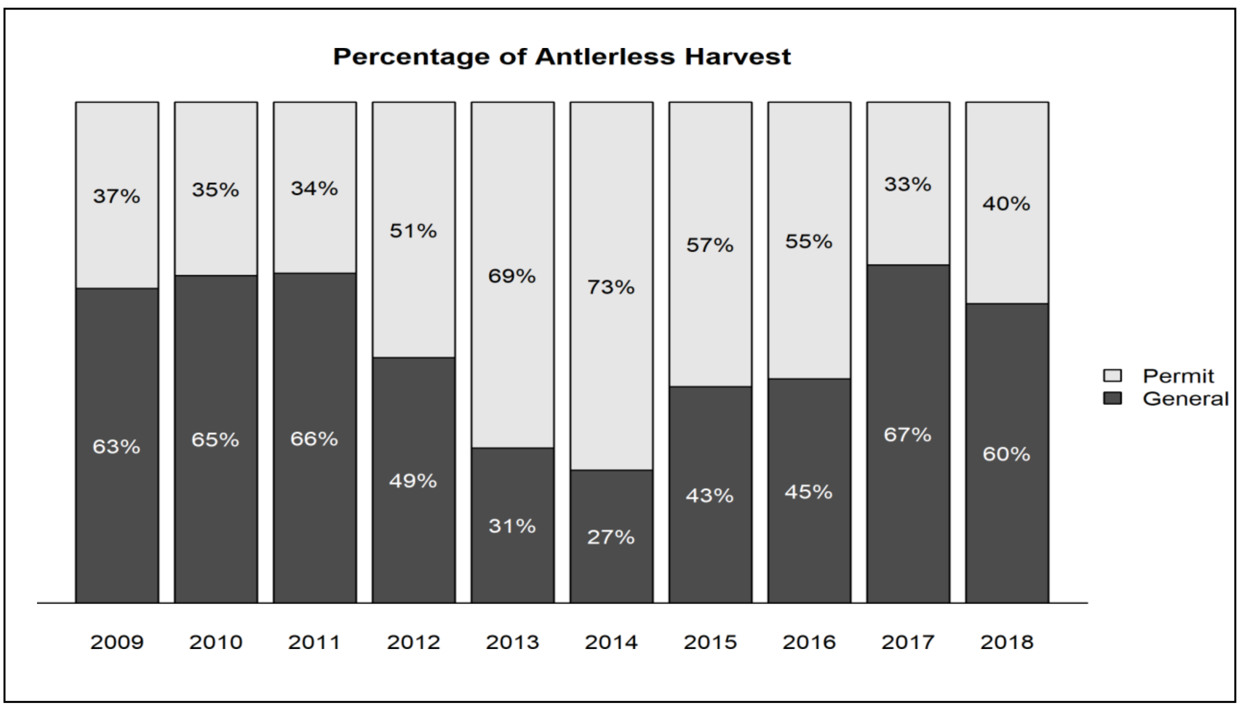

Figure 7. Estimated percentage of recreational antlerless harvest in the Colockum elk herd area that occurred during general and permit seasons, 2009–2018.

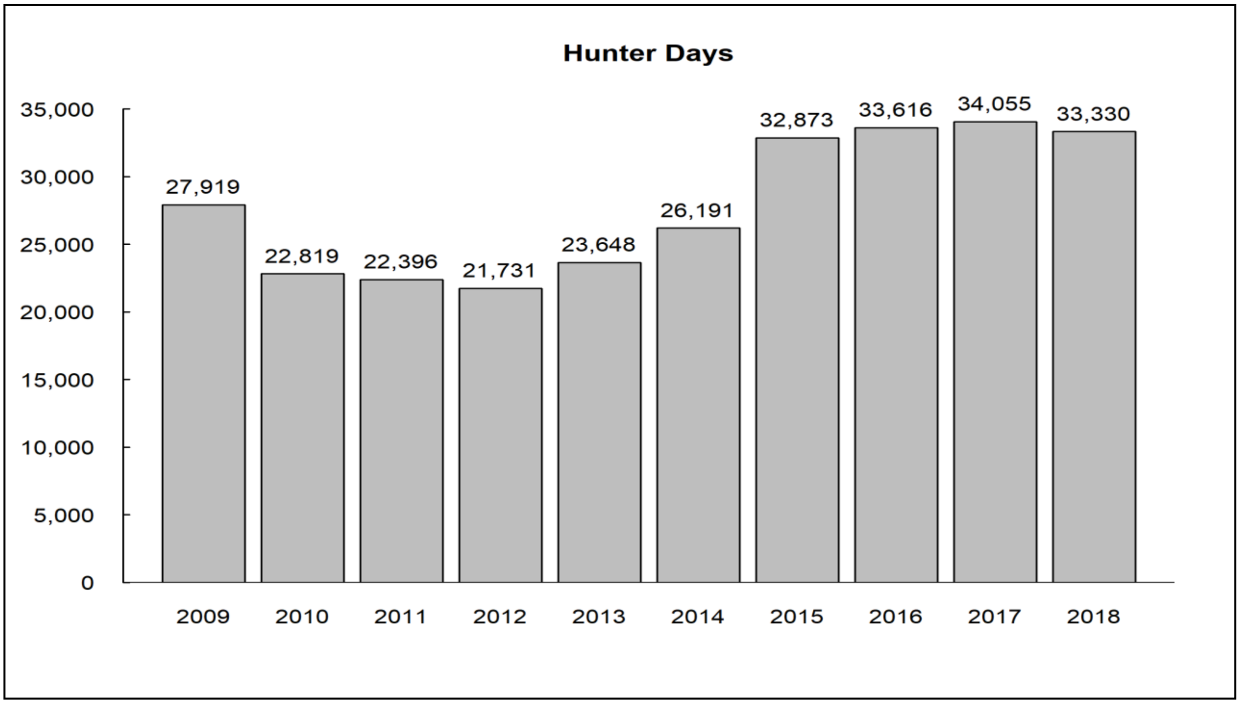

Figure 8. Estimated number of days hunters spent pursuing elk in the Colockum elk herd area during recreational seasons that provided general over-the-counter opportunities, 2009–2018.

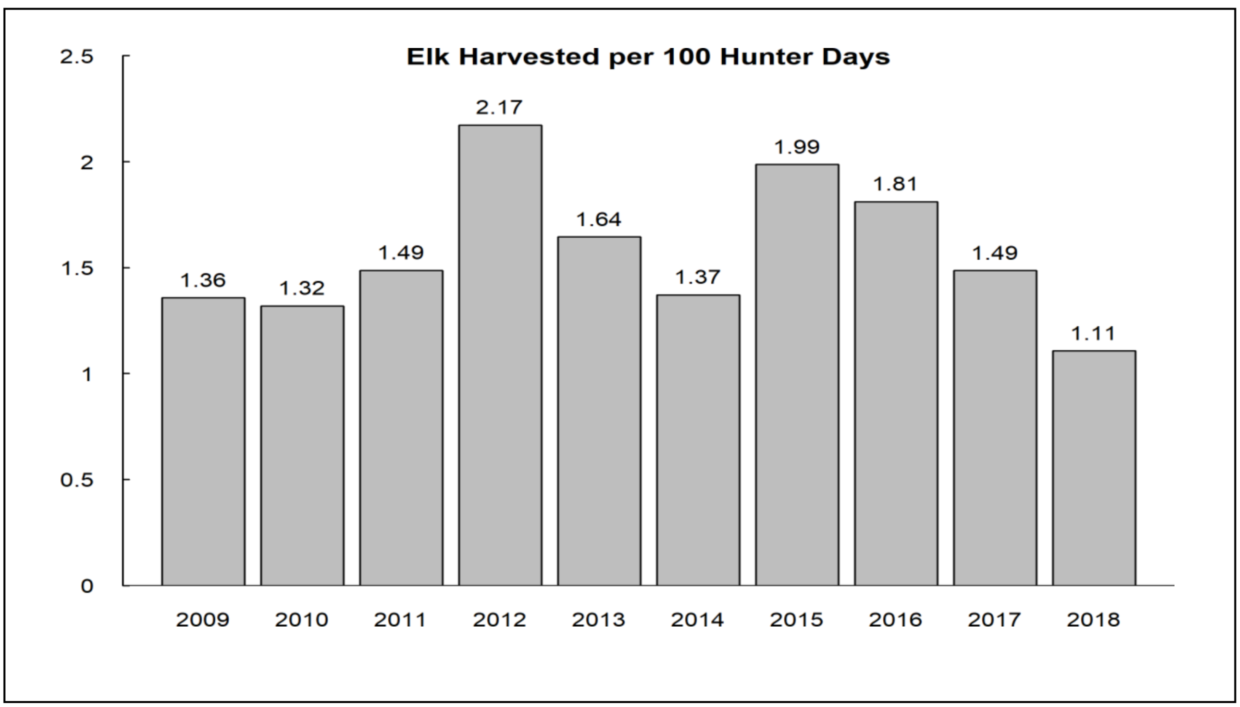

Figure 9. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the Colockum elk herd area during recreational seasons that provided general over-the- counter opportunities, 2009–2018.

Survival and Mortality

Common elk predators that occur within the Colockum elk herd area include black bears, cougars, and gray wolves. Black bears and cougars occur throughout the herd area, but black bears are more abundant in forested habitats. At the time of this writing, there were two confirmed wolf packs within the Colockum elk herd area (WDFW et al. 2019). WDFW has yet to collar a member of the small pack within the Colockum elk core range east of Highway 97.

The Colockum elk herd, like most elk herds, is typically robust to severe winters. The Department monitored the survival of 105 adult cow elk captured on core winter range 2008–2012 and estimated annual survival rates to be 0.92 (95% CI = 0.87–0.96); 73% of all mortalities were attributed to hunter-harvest (S. McCorquodale, WDFW, unpublished data). The Department also monitored the survival and movements of radiomarked branch-antlered bulls, 2013–2017. Fifty-five radiomarked bulls were monitored; annual survival was estimated to be 0.81 (95% CI = 0.61–0.94) for subadult bulls and 0.63 (95% CI = 0.49–0.76) for mature bulls. Twenty-five bull mortalities were documented, 21 of which were attributed to hunter-harvest (S. McCorquodale, WDFW, unpublished data). Bracken and Musser (1993) attributed all Colockum elk mortality in an earlier study to humans.

Although survival was not monitored directly, biologists observed a substantial number of elk carcasses during their annual survey following the winter of 2015-2016, which is uncommon and an indication that overwinter survival rates were reduced across all age and sex classes. Antlerless harvest was being increased to reduce the population at the same time. After an antlerless harvest of 445 in 2014 (Fig. 5), the population increased slightly (Figure 2). Antlerless harvest increased 261 to 706 harvested elk from 2014 to 2015, but the population decreased >1,000 elk. The decline was mostly the result of high late winter mortality followed by record low calf recruitment. Both were the result of a severe drought in 2015, which likely impacted body fat reserves and resulted in reduced pregnancy rates and calf recruitment.

Habitat

Timber harvest in the Colockum elk herd area increased as timber companies logged heavily 10-20 years ago, prior to selling their lands. The logging was followed by the 42,000+ acre Table Mountain fire in 2012. Wildfires also burned more than 100,000 acres of winter range in 2013. Smaller fires have occurred annually. In summer range, fires increase forage quantity and quality, but reduce security in a heavily roaded landscape. On arid portions of winter range, fires typically convert vegetation to grass (cheatgrass on south slopes). This likely has a negative impact on elk because of reduced plant diversity and poor forage quality of invasive plants.

Human-Wildlife Interaction

The Colockum herd is not fenced from private lands, and damage is being managed by hunting, damage permits, 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 1st – February 28th. In recent years, the general damage season closed January 20th. Additional problem elk are being managed through hazing, Damage Prevention Cooperative Agreements (DPCAs), and Master Hunter Permits. The goal is to displace elk that have developed a habit of foraging on agricultural lands. In 2018, conflict staff issued 335 permits in response to damage complaints, with a reported harvest of 46 elk.

During winter 2015-2016, elk were crossing Interstate-90, presumably in search of suitable forage immediately adjacent to the highway or in the median. The Department of Transportation documented at least 70 elk/vehicle collisions on Interstate-90 adjacent to the Colockum elk herd core winter range, mostly in the westbound lanes. Currently, there is no barrier to keep elk off the highway, nor engineered wildlife crossings. WDFW responded to this issue in 2016 by hazing elk away from the highway and installing a temporary 3-D fence to keep elk from approaching the highway. However, the effectiveness of these approaches are limited, so WDFW will have to work closely with the Department of Transportation to identify long-term solutions if similar events occur in the future. Elk-vehicle conflicts were much lower the last 3 winters.

Research

The previous research projects on Colockum elk have been concluded. No new research is planned for the near future.

Management Concerns

The Colockum herd has decreased and is now below the desired population objective. The main factors contributing to that decrease were increases in antlerless harvest, drought, and severe winter events during the winters of 2015-2016 and 2016-2017. To prevent further declines, the Department has reduced permit opportunities for modern firearm and muzzleloader hunters to harvest antlerless elk, in addition to shortening the general archery antlerless season. With the population below objective and total calf recruitment being low because of fewer adult cows, further reductions in opportunity will be needed to increase the population back to objectives.

Agricultural damage is frequently a concern for some landowners in the Colockum elk herd area. There are many factors that cause elk to move into areas where they are in conflict with private landowners. Cultivated lands and irrigated pasture are attractive foraging areas for elk. Human disturbance can be high on public lands, especially during late summer, during fall hunting seasons, and in late winter when people begin hunting for shed antlers. Elk are widely distributed during times of the year when human disturbance is low, but they become concentrated in areas associated with the Coffin Game Reserve when human disturbance is high. The reserve offers security for elk on a landscape where secure areas are very limited.

The main tool used to manage damage has been to issue damage permits and maintain long Master Hunter seasons. Harvesting elk is less desirable than preventing elk from entering fields. Some funding for cooperative fencing recently became available. The most efficient fence would be a boundary fence along irrigated fields where elk come off public land. For fences to be effective, all landowners along the boundary would need to agree to a fence so that there would not be gaps. Unfortunately, WDFW has not been able to obtain full landowner agreement.

Much of the Colockum elk herd area also has a high road density and limited security cover. The high road density and lack of cover historically resulted in high yearling bull vulnerability to hunting. The true-spike regulation has more than doubled yearling recruitment and increased the overall bull population. Since 2016, the estimated bull:cow ratio was above objective for the traditional winter range that is surveyed. However, in many years a proportion of the mature bull subpopulation is difficult to detect or is not located on the surveyed portion of the winter range. New techniques/methods may need to be adopted to better estimate the total bull subpopulation.

Management Conclusions

The Colockum herd is now below the desired total population objective and may continue to decline if reductions in harvest opportunities do not result in substantial reductions in antlerless harvest. The Colockum herd has reached bull:cow ratio objectives. True-spike general season hunting has reduced yearling bull mortality to the point where branch-antlered bull opportunity can be increased, while maintaining enough adult bulls to keep the herd within the 12-20:100 cows objective. Adjustment of the current survey structure is needed to better estimate the full complement of adult bulls in the population.

Literature Cited

Bracken, E. and J. L. Musser. 1993. Colockum elk study. Wash. Dept. Fish and Wildlife. Fed. Aid Wildl. Restor. Rep. Proj. 129 p.

Unsworth, J. W., F. A. Leban, E. O. Garton, D. J. Leptich, and P. Zager. 1999. Aerial Survey: User's Manual. Electronic Edition. Idaho Department of Fish and Game, Boise, Idaho, USA.

Washington Department of Fish and Wildlife. 2006. Colockum Elk Herd Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA.

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

Washington Department of Fish and Wildlife, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Washington Department of Fish and Wildlife, Wenatchee, WA, USA.

Mount St. Helens Elk Herd

ERIC HOLMAN, Wildlife Biologist

Introduction

The Mount St. Helens elk herd is located in southwest Washington and is comprised of 14 GMUs, which includes 505 (Mossyrock) 520 (Winston), 522 (Loo-Wit), 524 (Margaret), 550 (Coweeman), 554 (Yale), 556 (Toutle), 560 (Lewis River), 564 (Battle Ground), 568 (Washougal),572 (Siouxon), 574 (Wind River), 578 (West Klickitat), and 388 (Grayback) (Figure 1).

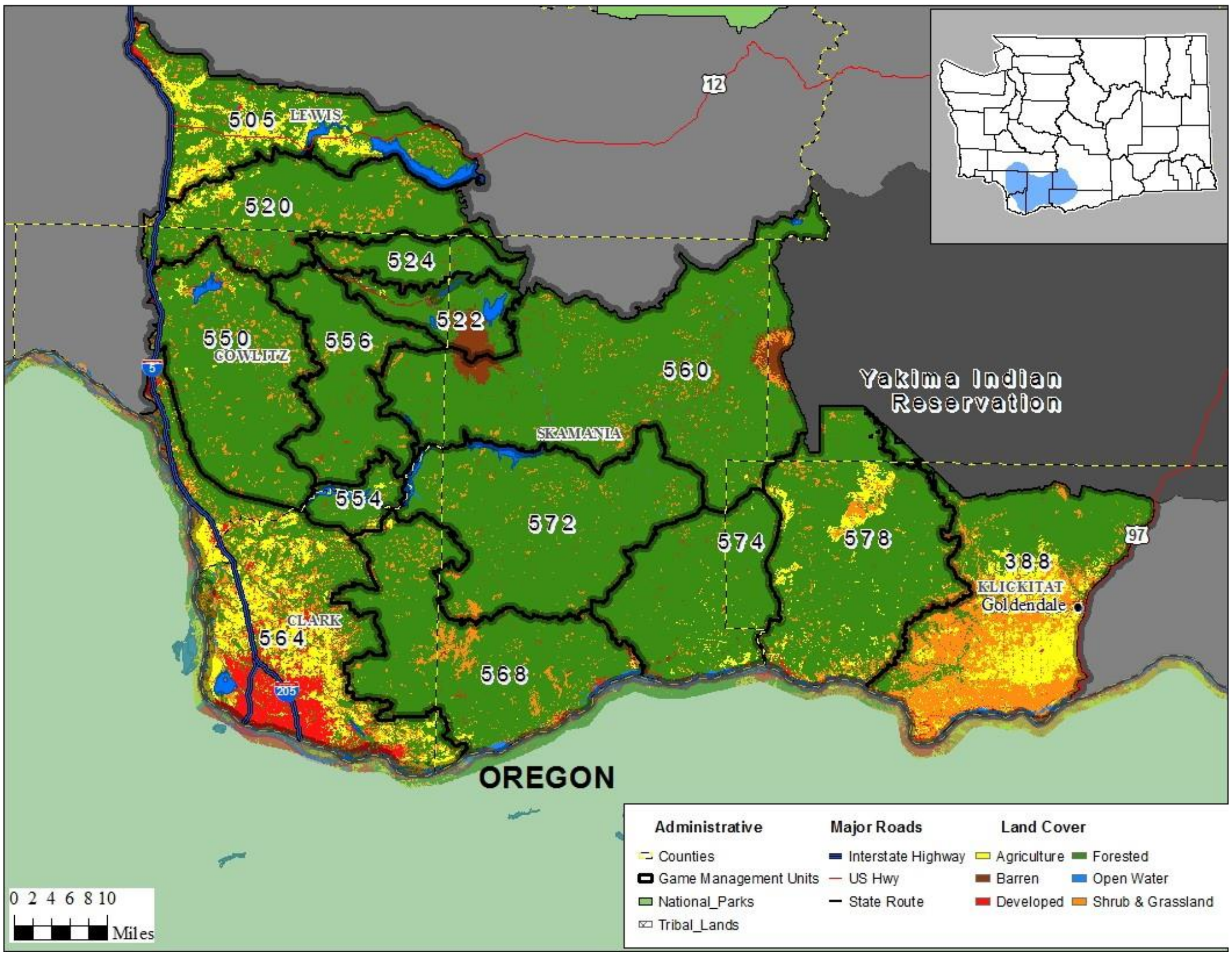

Figure 1. Dominant land use cover types within the 14 game management units that comprise the Mount St. Helens elk herd area.

Management Guidelines and Objectives

In response to the frequency and magnitude of winter mortality events in the 2000s, the Department began liberalizing opportunities to harvest antlerless elk in 2007 with the objective of reducing the Mount St. Helens elk herd by 35% (WDFW 2006). The Department's current objective is to promote population stability as indexed by estimates of total elk abundance in spring. Additional herd objectives include maintaining a post-hunt population with a bull:cow ratio of 12-20 bulls:100 cows and maintaining an annual survival rate of 0.50 for bulls when bull mortality is monitored (WDFW 2014). The Mount St. Helens Elk Herd Management Plan (WDFW 2006) also outlines objectives to continue efforts that monitor and improve winter habitat and wintering elk populations in the Toutle River valley. In addition, plan objectives that address minimizing damage conflicts, increasing public appreciation of the elk resource, and using sound science to monitor the herd.

Population Surveys

The Department began monitoring population trend in 2009 by indexing total elk abundance within the core herd area (GMUs 520, 522, 524, 550, 556) using a sightability model developed specifically for the Mount St. Helens elk herd (McCorquodale et al. 2014). In March 2019, the Department estimated total elk abundance within the core herd area to be 1,389 elk (95% CI 1,352-1,497). Estimates of total elk abundance had been relatively stable since the Department reduced opportunities to harvest antlerless elk following the 2012 season (Figure 2); however, after the severe winter of 2016-17 the abundance estimate declined by roughly 33%. In March 2019 the Department estimated post-hunt bull:cow and calf:cow ratios to be 40:100 and 35:100, respectively. Bull:cow ratios have increased since 2010 during the period of purposeful herd reduction and are well above management objective (Figure 3). Calf:cow ratios have ranged from 25-44:100 over the past 10 years (Figure 4).

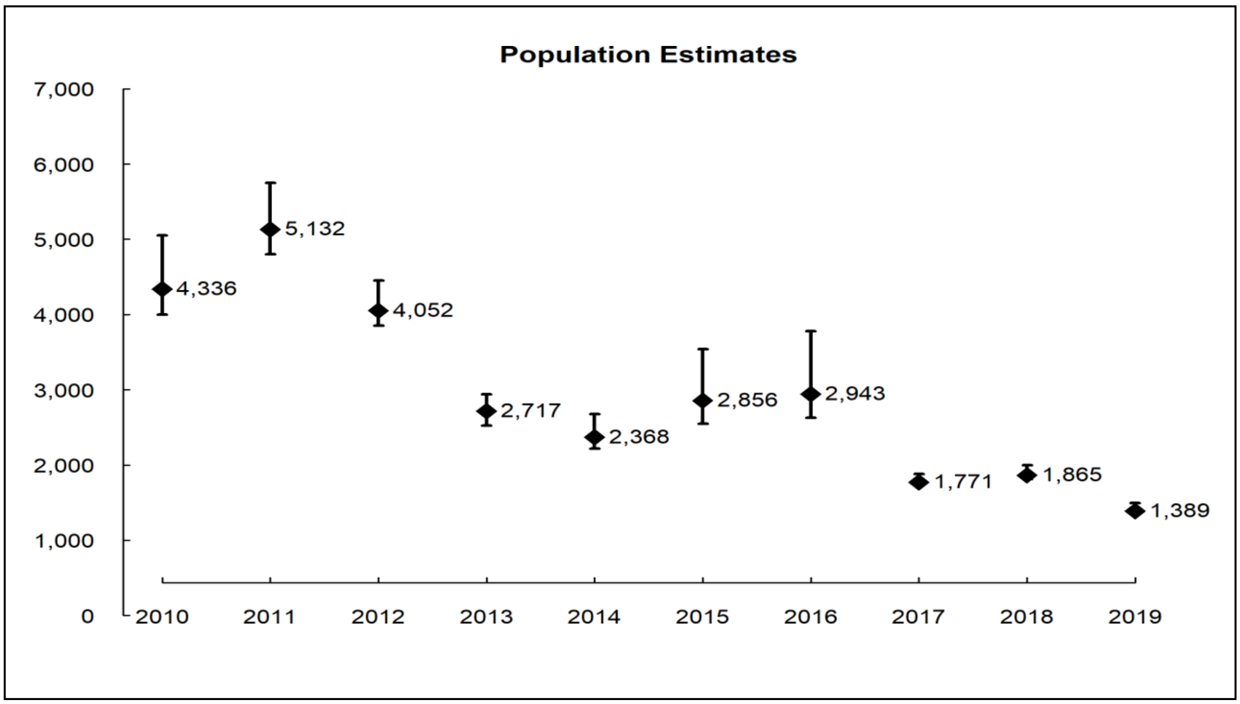

Figure 2. Sightability corrected estimates of total elk abundance with associated 95% confidence intervals in the core range of the Mount St. Helens elk herd area (GMUs 520, 522, 524, 550, 556), spring 2010-2019.

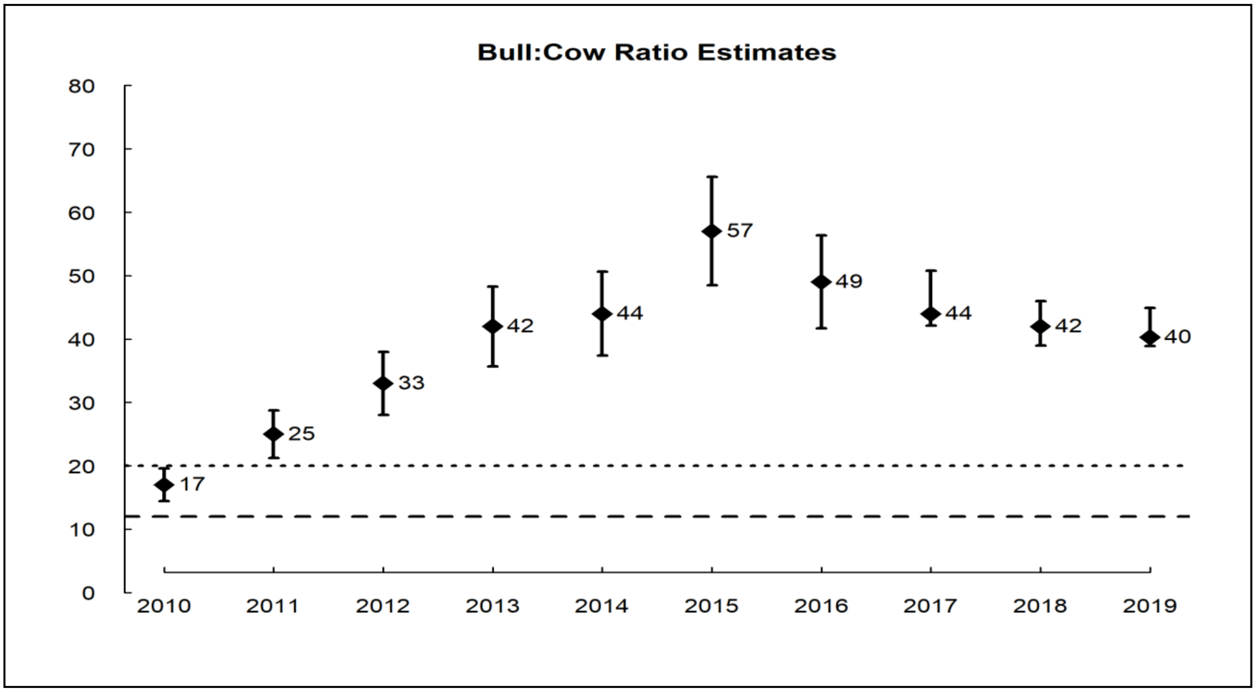

Figure 3. Estimates and associated 95% confidence intervals of post-hunt bull:cow ratios in the core range of the Mount St. Helens elk herd area (GMUs 520, 522, 524, 550, 556), spring 2010-2019. The dashed lines represent the objective range of 12-20 bulls:100 cows.

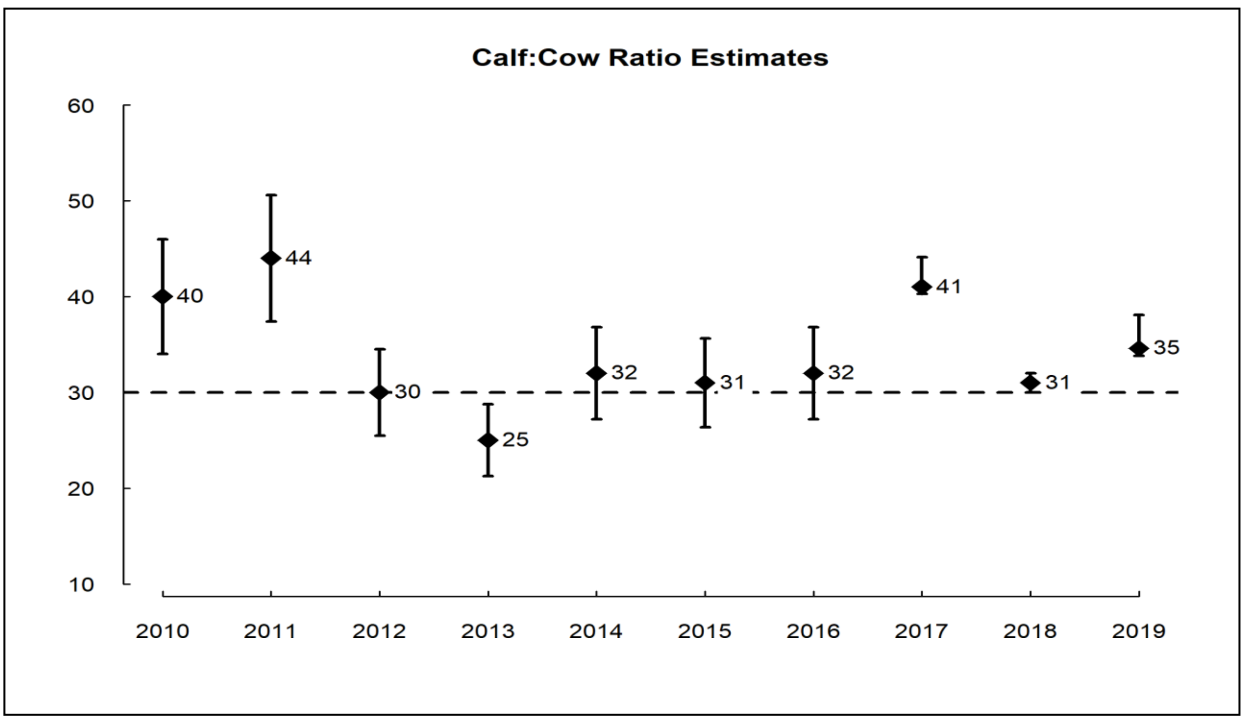

Figure 4. Estimates and associated 95% confidence intervals of post-hunt calf:cow ratios in the core range of the Mount St. Helens elk herd area (GMUs 520, 522, 524, 550, 556), spring 2010-2019. The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth.

Hunting Seasons and Recreational Harvest

The Department manages harvest opportunities in the Mount St. Helens elk herd with a combination of general season and special permit hunts. During the period of time this review covers, the Department restricted all elk harvest in GMUs 522 and 556 to permit only opportunities. The Department restricted elk harvest in GMU 524 to special permit only from 1983 through 2014, then changed management strategies by allowing general season opportunities for branch-antlered bulls starting in 2015.

Estimates of harvest during general seasons averaged 1,099 elk during 2009-2018 and have steadily declined during this 10-year period (Figure 5). Estimates of total harvest have averaged 1,732 elk since 2009, varied 2009–2012, and declined precipitously after the Department reduced opportunities to harvest antlerless elk in 2013 (Figure 5).

Harvest of antlered elk in the Mount St. Helens Herd area occurs primarily during general seasons and most hunts are managed with a 3-point or greater antler point restriction (Figure 6). In contrast, the majority of antlerless elk harvest occurs during permit-only seasons. However, limited opportunities to harvest antlerless elk during general seasons do occur in areas where the Department's objective is to maintain low numbers of elk or in areas where the population is robust enough to sustain general season harvest of females (Figure 7). Elk harvest within tribal hunting seasons are minimal in the Mount St. Helens Herd area, totaling just 7 antlered and 1 antlerless elk during 2009-18 (Figures 6 and 7).

Hunter effort within the Mount St. Helens Herd area has steadily declined since 2009 (Figure 8). In contrast, catch per unit effort (CPUE) has varied considerably during 2009-18, but reached a low point for this period during the 2018 hunting season (Figure 9).

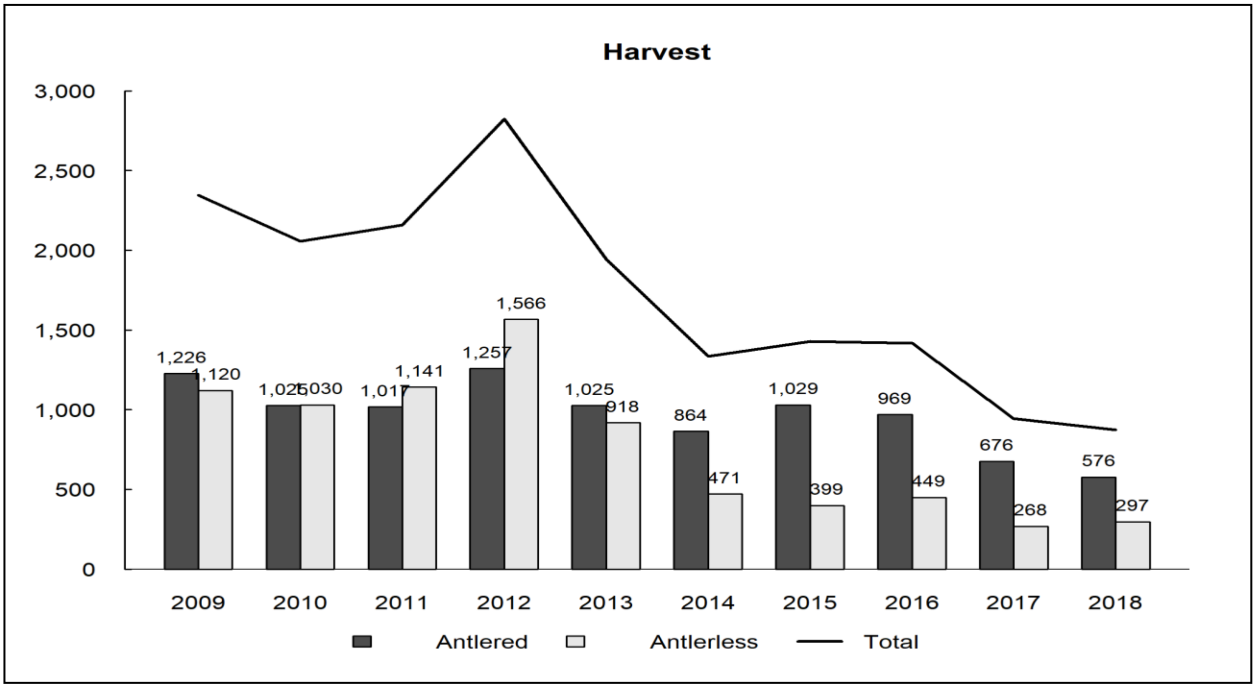

Figure 5. Estimated number of antlered and antlerless elk harvested in the Mount St. Helens elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department and during established Tribal seasons, 2009-2018. Estimates of Tribal harvest were derived from annual harvest reports compiled by the Northwest Indian Fisheries Commission. Estimates do not include elk harvested in association with damage permits (see Human Wildlife Interaction).

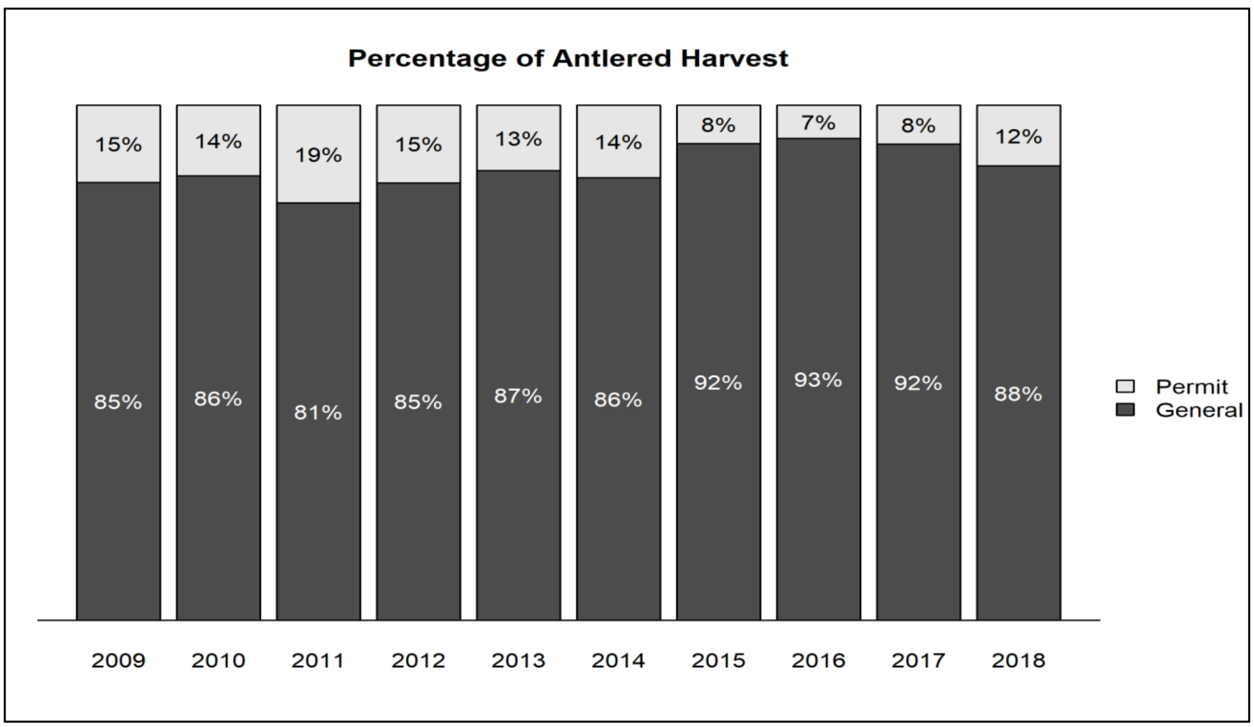

Figure 6. Estimated percentage of recreational antlered harvest in the Mount St. Helens elk herd area that occurred during general and permit seasons, 2009-2018. Harvest during established tribal seasons accounted for <1 % of the antlered harvest and is not reported here.

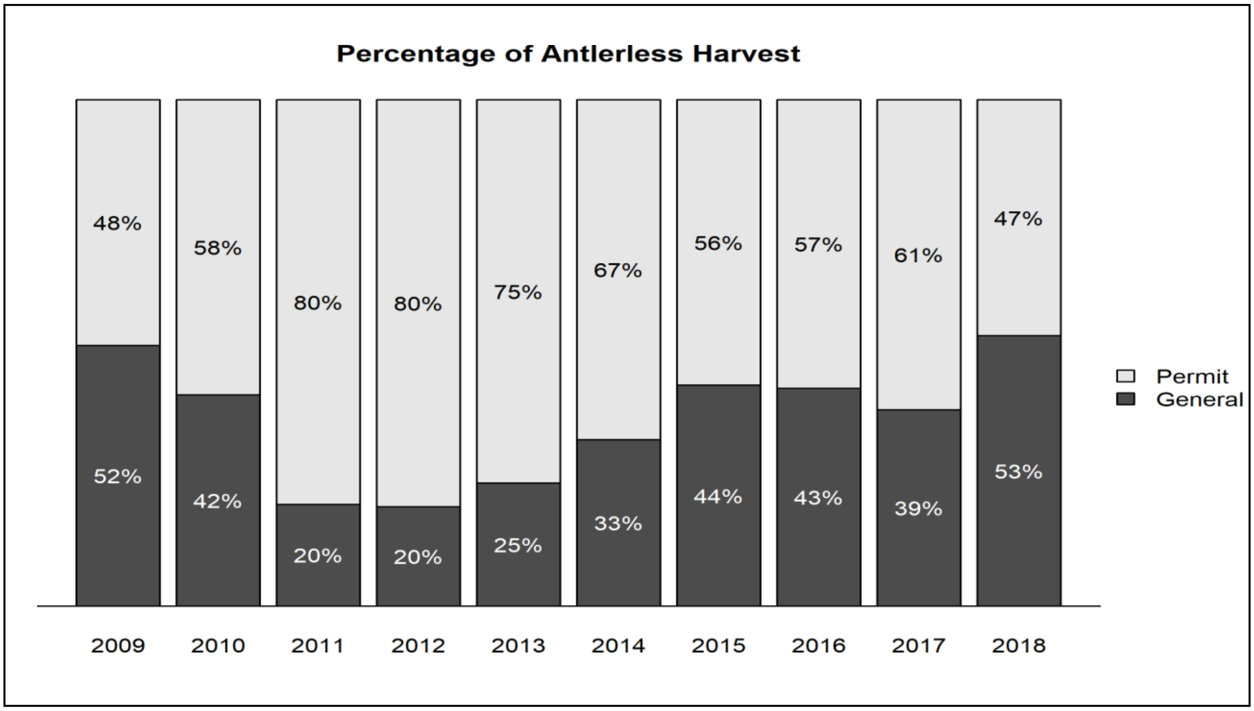

Figure 7. Estimated percentage of recreational antlerless harvest in the Mount St. Helens elk herd area that occurred during general and permit season, 2009-2018. Harvest during established tribal seasons accounted for 1 % of the antlerless harvest and is not reported here.

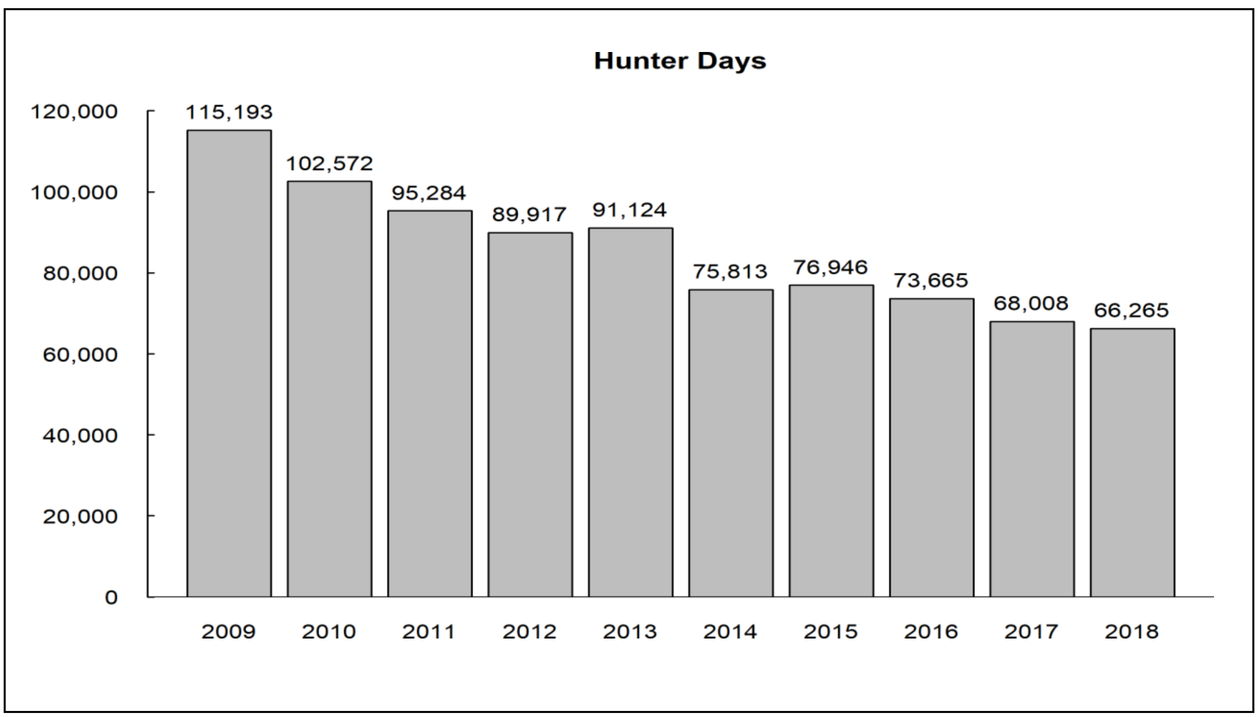

Figure 8. Estimated number of days hunters spent pursuing elk in the Mount St. Helens elk herd area during recreational seasons that provided general over-the-counter opportunities, 2009-2018.

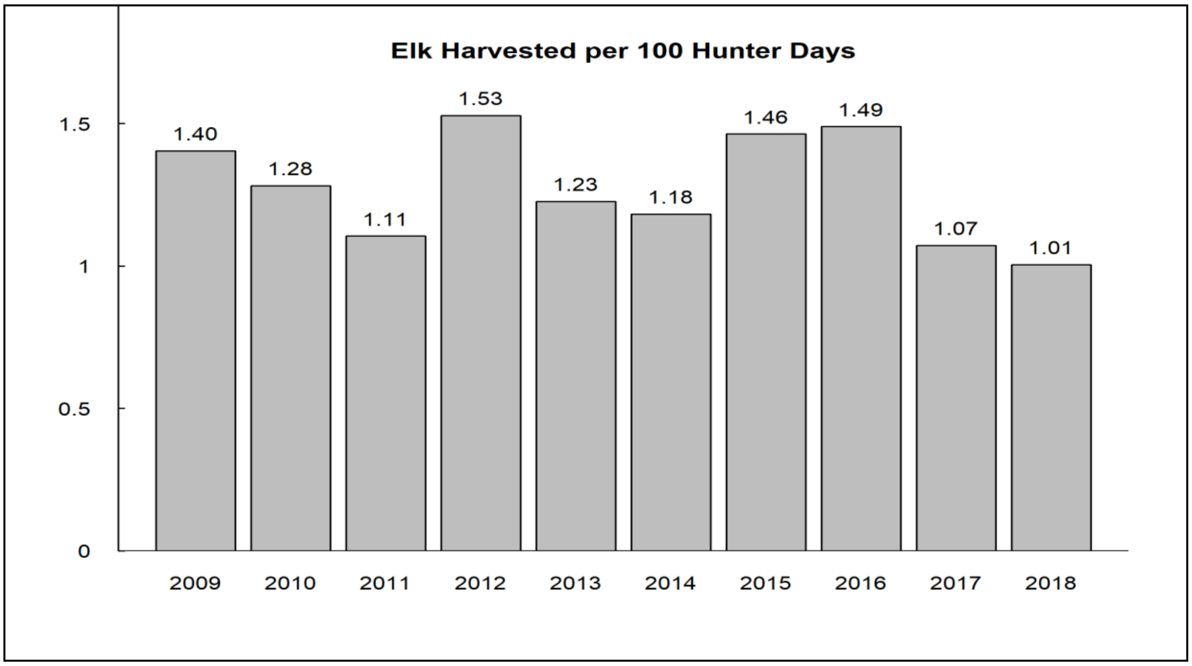

Figure 9. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the Mount St. Helens elk herd area during recreational seasons that provided general over- the-counter opportunities, 2009-2018.

Survival and Mortality

Common predators that occur throughout the Mount St. Helens elk herd area include black bears and cougars. At the time of this writing, there are no documented gray wolf packs in the herd area (WDFW et al. 2019).

Some elk in portions of the Mount St. Helens elk herd area are susceptible to increased overwinter mortality events when severe winter and dry summer-fall conditions persist (McCorquodale et al. 2014). Since 1999, the Department has conducted an annual winter elk mortality survey on the Mount St. Helens Wildlife Area and documented the number of elk carcasses detected. Since that time, the number of elk carcasses detected has varied annually, averaging 36 per year and has been above the 21-year average on 7 separate occasions, most recently in 2014. Twenty-five carcasses were located during the 2019 survey.

The Department recently completed monitoring the survival and movements of adult cow elk in GMUs 520, 522, 524, 550, and 556. The study of elk in this portion of the Mount St. Helens elk herd area is an effort to determine the effects of treponeme-associated hoof disease (TAHD) on elk survival and reproduction. The project spanned February 2015 through May of 2019 and involved the capturing, collaring and monitoring of 178 individual elk. The Department has not analyzed this information to date.

The Department (McCorquodale et al. 2014) monitored the survival of branch-antlered bulls and adult female elk from 2009–2013 but did not attempt to account for elk mortalities by cause beyond distinguishing between hunting-related and natural causes (e.g., predation, disease, winter mortality, etc. combined). Estimated annual survival of adult female elk in GMUs 520, 522, 524, and 556 was 0.85 (95% CI 0.78–0.91) from 2009–2011 and 0.52 (95% CI 0.38–0.65) in 2012.

Estimated annual survival rates of adult female elk in GMU 550 from 2009–2011, were 0.64 (95% CI 0.48–0.78) and 0.52 (95% CI 0.38–0.65) in 2012. Estimated branch-antlered bull survival was 0.56 (95% CI 0.43–0.67) across years and GMUs. Most mortality events were associated with harvest-related causes in 2009–2011, while the reduced survival in 2012 was attributed to increased winter-mortality.

Habitat

The majority of the landscape that comprises the Mount St. Helens elk herd area is a roughly even split of private industrial forestlands and U.S. Forest Service (USFS) managed lands. Smaller portions of the herd area are made up of State Department of Natural Resources (DNR) managed forestlands, agricultural areas, urban/suburban lands, small forestland ownerships, WDFW, etc.

The industrial forestlands consist of a mosaic of clearcuts, relatively open young regeneration stands, dense second growth stands of timber, and stream buffers lined with second-growth forest. Industrial timber management practices benefit elk by increasing the quantity of early seral habitats and the subsequent forage base. While beneficial to elk, management practices are not conducted to purposefully increase or improve elk habitat. Additionally, intensive forest management practices including the planting of dense stands of fast-growing conifer seedlings and the application of herbicides during re-establishment of the timber stand may also be affecting overall productivity due to reduced forage quality and availability. These effects work in tandem by reducing the amount of favorable plants available as forage in the early term and completion of forest canopy closure (typically approximately age 12) far earlier than would occur in a naturally regenerated stand. The magnitude of those effects is influenced by site specific types of post-timber harvest treatments and plant compositions and the number of years since timber harvest. A commonality among all of these varying factors is that the best quality and most quantity of favorable forage seems to occur approximately 3 to 14 years after timber harvest whether herbicide treatments are applied or not. However, the differences between available, favorable forage in that time period for treated and untreated stands can still be substantial. A full discussion on the complexity of these habitat interactions is beyond the scope of this report and we refer the reader to Ulappa (2015) and Geary et al. (2012) for a more comprehensive understanding of this research.

In contrast, very limited timber harvest on federal forests in the last three decades has led to a general decline in the quality of elk habitat. The Department continues to take steps to enhance forage quality on the North Fork Toutle River Mudflow Unit of the Mount St. Helens Wildlife Area within GMU 522. Forage enhancement efforts have included planting and fertilizing forage plots; mowing pasture; controlling Scotch broom, yellow and mouse-ear hawkweed, and non-native invasive blackberries; planting trees in upland areas and along the banks of the North Fork Toutle River to reduce bank erosion; and reestablish tree cover in areas where Scotch broom had been removed.

The Department recently completed habitat enhancement activities on the Hoffstadt Unit of the Mt. St. Helens Wildlife Area. This work included conducting thinning of dense conifer stands, creating openings within forested stands, treating invasive plants, establishment of forage including grasses, clover and peas on abandoned roadways and landings, and re-establishing diverse forest stands. These enhancements were conducted in portions of GMUs 522, 524 and 556.

In addition, activities on approximately 15,000 acres of 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 enhanced habitats provide high-quality foraging opportunities for elk.

Human-Wildlife Interaction

Conflicts with the production of agricultural crops occur throughout the lower-elevation portions of the Mount St. Helens Elk Herd area. Elk damage complaints have decreased in recent years, reflecting the reduced elk population. A variety of crops are impacted by elk damage, but most of the damage occurs on fields used for hay production.

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 an important component to reducing elk damage and are generally attempted prior to the use of lethal response. Conflict Specialists and landowners use a variety of non-lethal means including electrified fladry fencing; noisemakers (bird bangers, critter gitters, propane cannons); and hazing and herding on foot, with a vehicle or with a dog, scarecrow-like electronic devices; and odor-based repellents such as Plantskyyd.

Lethal methods of deterring elk are also used. These efforts include special late and early season damage hunts within specified elk areas, a region-wide pool of Master Hunters, Youth Hunters and Hunters with Disabilities for immediate response to damage issues, as well as landowner damage permits. Collectively, these hunts are designed to decrease the number of elk causing the damage and/or to haze elk from the area.

In recent years, the most acute situation of elk damage to agricultural crops has been associated with the mid-elevation valleys of Trout Lake and portions of the Glenwood and Gilmer valleys within GMU 578. These valleys provide year-round habitat and are considered historic winter-range for elk occupying the south Cascade mountains. The aggressive use of landowner kill permits and some non-lethal deterrents have failed to reduce this conflict over the course of many years. In order to help with this conflict, the Department proposed, and the Commission approved, a liberalized late muzzleloader season in GMU 578 starting in 2018.

Table 1 shows a summary of permits issued to landowners allowing the take of elk causing agricultural damage in the Mount St. Helens Elk Herd during 2018-19. Collectively, these hunts are designed to decrease the number of elk causing damage and/or to haze elk from the area.

Table 1. Number of Permits to Lethally Remove Elk Causing Damage to Agricultural Crops and Resulting Kills, Mt. St. Helens Elk Herd, 2018-19.

Game Management Unit	Permits Issued	Elk Removed
505	12	9
520	3	3
554	2	1
568	3	3
574	5	2
578	41	27
TOTAL	**66**	**45**

Research

The research associated with TAHD discussed above is scheduled for data analysis during 2020. It is anticipated that this effort will shed light on the impacts of TAHD on the survival and reproductive fitness of adult female elk. Additional information will include survival rates and reproductive fitness of elk not afflicted with TAHD, habitat use, cause-specific mortality among study animals, and other variables.

Management Concerns

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. Elk severely affected by TAHD often have reduced mobility and condition. Consequently, it seems reasonable to assume elk would have a reduced probability of survival or reproductive potential. However, it is unknown how TAHD affects the population dynamics of herds where TAHD occurs. This is the focus of ongoing research. The Department is also conducting research to better estimate the distribution and prevalence of TAHD. To learn more about the Department’s efforts associated with investigating TAHD, please visit the Department’s hoof disease webpage: https://wdfw.wa.gov/species-habitats/diseases/elk-hoof

Habitat Conditions on Federal Lands

Habitat conditions on federally managed lands within the Mount St. Helens elk herd area are of concern. Large scale fire, timber harvest, disease, or other succession re-setting events are largely absent from the federal lands. The resulting landscape is dominated by closed-canopy forest, much of which was harvested from roughly 1950-1990 and subsequently replanted with dense Douglas fir trees. These stands provide little in the way of elk forage and lack the diversity and forage resources of either older or younger forests. While some forest thinning was completed by the USFS and do provide more robust forage resources, at least temporarily, elk forage and therefore elk populations will continue to be suppressed in GMUs 560, 572, and 574.

Fee-Only Hunting Access Restrictions

In 2014, the largest industrial forestland owner within the Mount St. Helens elk herd area implemented a fee-only access system for hunting and other recreation on their lands. This system limited the number of individuals allowed access to these lands and has continued in the years that have followed. The effects of this limited access to elk hunting opportunity are difficult to quantify as the landowners don't own entire Game Management Units, some individuals elect to pay the access fee, some individuals elect to hunt in another area, and some may decide to quit hunting. It is probable that the reduction in participation over the years illustrated in Figure 8 above partially reflects this reduction in free, unlimited hunting access within a large portion of the Mount St. Helens elk herd area. Ramifications of reduced hunter access and participation are twofold in as much as it impacts the Department's goals to maximize recreational access to wildlife and likely reduces hunter participation and recruitment, therefore undermining capacity to manage elk and other wildlife.

Management Conclusions

Harvest and survey data indicate the Mount St. Helens elk herd has declined in accordance with the Department's objective of reducing herd size by 35%. The Department began managing for population stability in 2012. Estimates of total elk abundance indicated a stable population during the period spanning 2013-2016.

The winter of 2016-17 was unusually severe. Population surveys conducted in the spring of 2017 indicated a decline of roughly one-third in the surveyed portion of the Mount St. Helens elk herd. However, estimated calf:cow ratios suggest calf recruitment rates are at levels that would promote population growth or stability. In addition, recent estimates of bull survival indicate the Department is achieving its management objective of maintaining annual survival rates of 0.50 for bulls. Opportunities to harvest antlerless elk were reduced for the 2017 hunting season and have been further reduced for 2018 and 2019 seasons as a means of moderating the effect of the severe winter. Surveys conducted in the spring of 2019 indicated an additional decline in the elk population.

The effects of the 2016-17 winter, treponeme associated hoof disease, habitat condition on federal lands, and fee-access systems remain concerns for the Mount St. Helens elk herd.

An updated herd plan is needed for the Mount St. Helens elk herd. The existing plan is now more than 10 years old and does not reflect current conditions. Specifically, the plan was written before the presence of hoof disease in southwest Washington elk and prior to the organizational change of wildlife management staff addressing wildlife-human conflicts.

Literature Cited

Geary, A.B., J. G. Cook, R. C. Cook, and E. H. Merrill. 2012. Herbicide and Herbivory Effects on Elk Forages at Mt. St. Helens. Final research report. University of Alberta and National Council for Air and Stream Improvement. 44 p.

McCorquodale, S. M., P. J. Miller, S. M. Bergh, and E. W. Holman. 2014. Mount St. Helens elk population assessment: 2009–2013. Washington Department of Fish and Wildlife, Olympia, Washington, USA.

Ulappa, A. 2015. Using foraging dynamics to answer landscape management questions: the nutritional ecology of black-tailed deer. Dissertation, Washington State University, Pullman, WA, USA.

Washington Department of Fish and Wildlife, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Washington Department of Fish and Wildlife, Wenatchee, WA, USA.

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

Washington Department of Fish and Wildlife. 2006. Mt. St. Helens Elk Herd Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA.

North Cascade Elk Herd

ROBERT WADDELL, Wildlife Biologist

Introduction

The North Cascade Elk Herd (NCEH) is the smallest of 10 herds formally managed by the Washington Department of Fish and Wildlife (WDFW or Department). The herd area is located in northwest Washington and consists of 5 GMUs (Figure 1), which includes 407 (North Sound), 418 (Nooksack), 437 (Sauk), 448 (Stillaguamish), and 450 (Cascade).

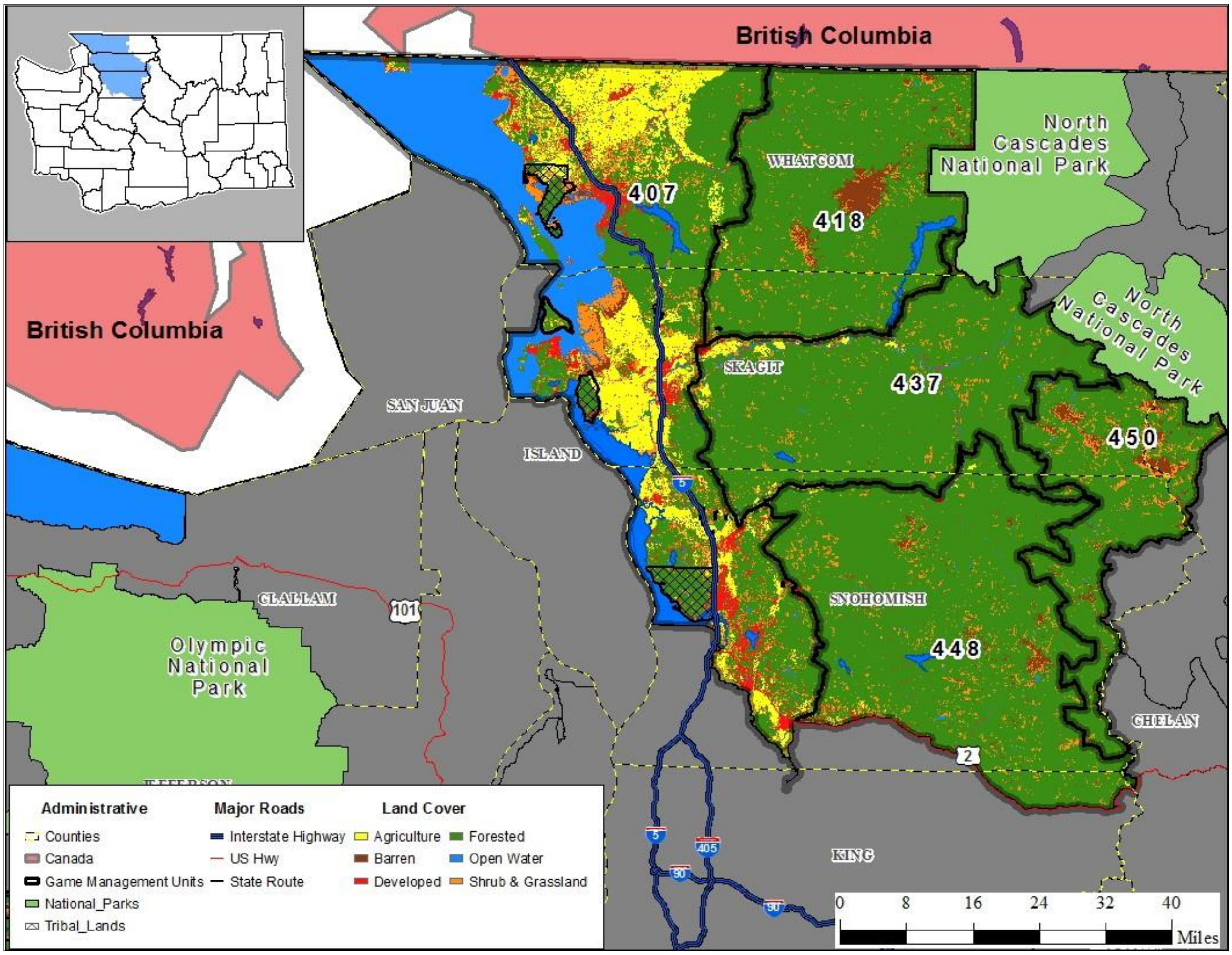

Figure 1. Dominant land use cover types within the 5 game management units that comprise the North Cascade elk herd area.

Management Guidelines and Objectives

The Department recently completed the NCEH Plan (WDFW 2018). Current objectives include maintaining a post-hunt population with a bull:cow ratio of 12-20 bulls:100 cows and maintaining an annual survival rate of greater than 0.50 for bulls, when bull mortality is monitored (WDFW 2014).

Population Surveys

The Department, in cooperation with the Point Elliot Treaty Tribes, conducts aerial composition surveys during spring in the core herd area (GMU 418 and Elk Area 4941 within GMU 437). We derive estimates of total elk abundance and estimates of the cow subpopulation within the survey area using a variant of mark-resight known as the logit-normal mixed effects model (McCorquodale et al. 2011, 2013), whenever the required replicate flights during a survey period are performed. When single aerial surveys are performed due to weather, cost, or other factors, as in 2017 and 2018, total elk abundance is based on a Lincoln-Petersen estimate.

In spring 2019, biologists estimated total elk abundance within the core herd area to be 1,493 (95% CI = 1,390–1,603) elk (Figure 2). Estimates of bull:cow and calf:cow ratios derived from uncorrected observation data were 21 bulls:100 cows and 37 calves:100 cows, respectively. Bull:cow ratios remain at levels above the post-hunt management objective of 12–20 bulls:100 cows (Figure 3), and calf:cow ratios have represented good to excellent calf recruitment rates in most years (Figure 4).

Hunting Seasons and Recreational Harvest

The Department and Point Elliot Treaty Tribes implemented a harvest moratorium throughout most of the herd area during 1997-2006 because managers believed the herd had declined to as few as 300 elk. Managers reinstated limited opportunities to harvest bulls in 2007 and allocated those opportunities equally between state and Tribal hunters; that approach continues to this day. General season opportunities continue to be limited, but managers have increased special permit opportunities as the population has increased. Concomitantly, antlerless harvest has expanded over the past few years and is primarily limited to agricultural areas where conflict with commercial agricultural producers can be high.

Estimates of antlerless harvest have remained steady to increasing since 2014, whereas estimates of antlered harvest generally have increased during the same period (Figure 5). Estimates of antlered harvest during 2015-2018 have remained high (Figure 5), compared to previous years, due to increases in estimated elk abundance, increases in special permit opportunities, high estimated bull:cow ratios (Figure 3), and a need to address crop damage concerns. In 2018, Tribal seasons accounted for a higher percentage of estimated antlered harvest and a lower percentage of estimated antlerless harvest, compared to general and permit seasons (Figures 6 and 7).

The estimated number of days hunters spent pursuing elk within the NCEH during general recreational seasons, where over-the-counter license opportunities are available, remained steady from 2015-2017 (Figure 8). This number nearly doubled in 2018 (Figure 8), due to a large increase in the number of hunters seeking general season elk hunting opportunities in the NCEH. During the 2018 general recreational season, the estimated number of elk harvested for every 100 hunter days decreased from 2017 (Figure 9), likely due to the increased number of licensed hunters and limited access to private property where elk were present.

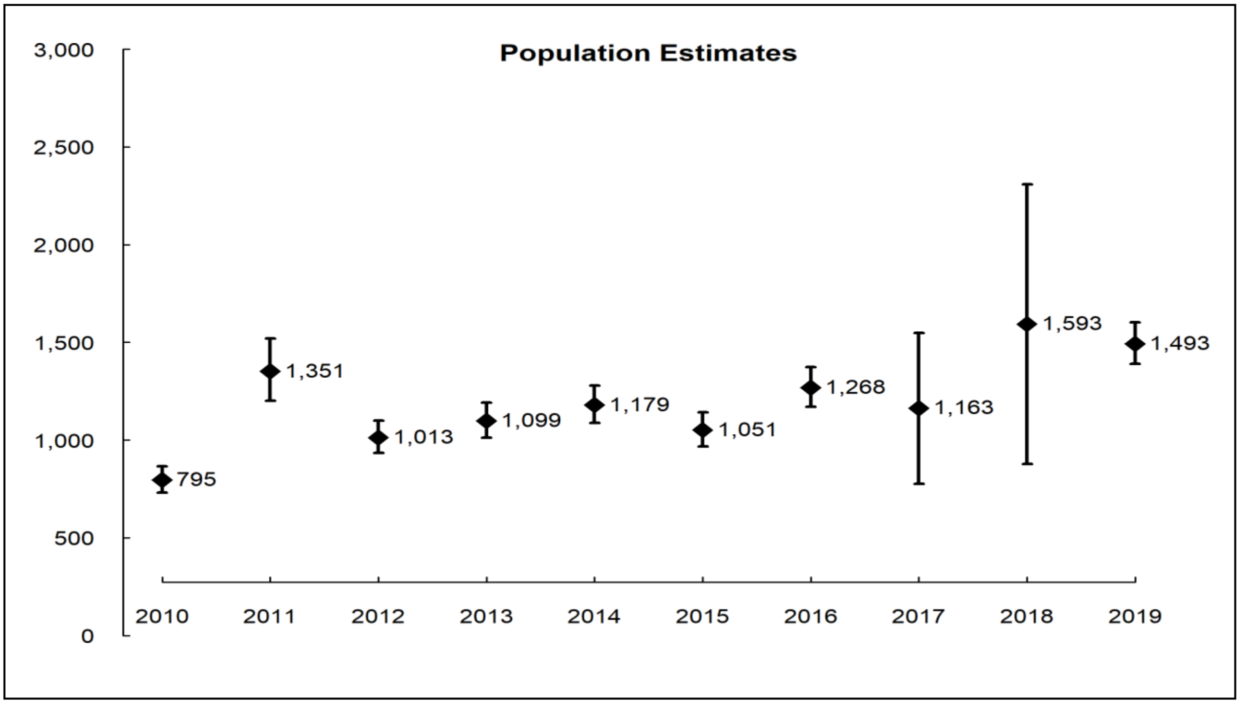

Figure 2. Estimates of total elk abundance using a variant of mark-resight or a Lincoln-Petersen estimator (2017 and 2018) with associated 95% confidence intervals in the core range of the North Cascade elk herd area (GMU 418 and Elk Area 4941), spring 2010–2019.

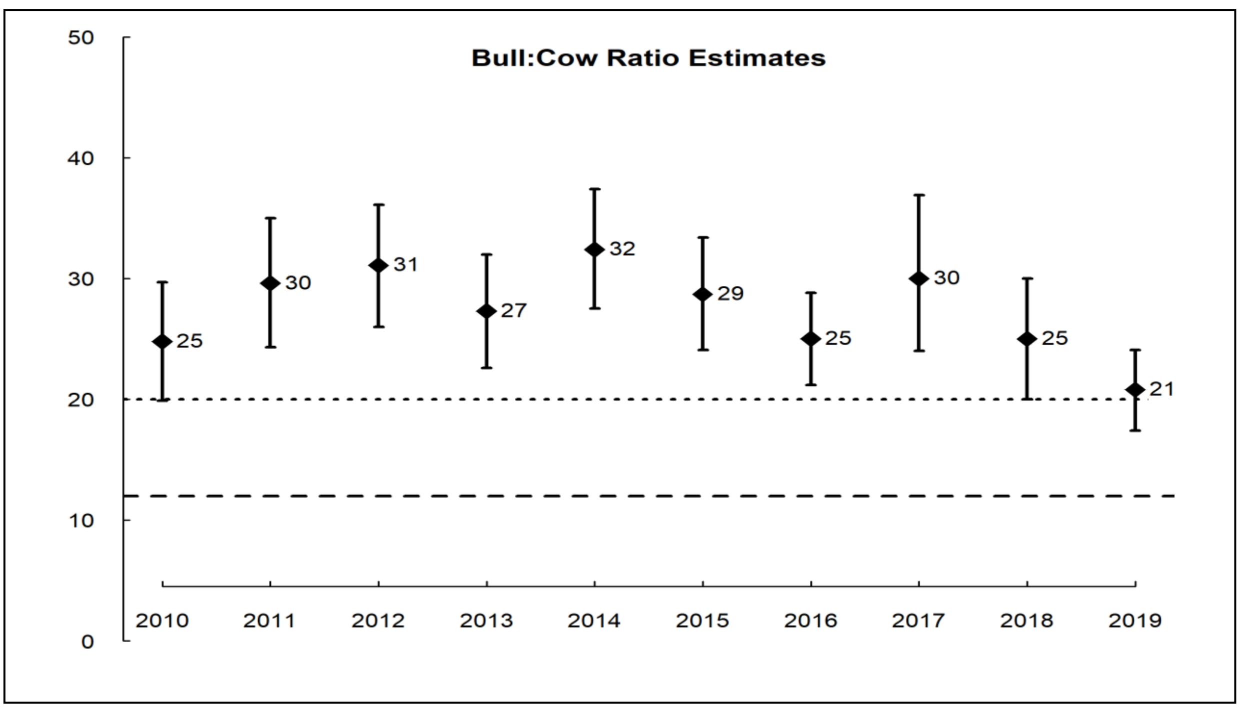

Figure 3. Estimates and associated 95% confidence intervals of post-hunt, bull:cow ratios in the core range of the North Cascade elk herd (GMU 418 and Elk Area 4941), spring 2010–2019. The dashed lines represent the WDFW post-hunt objective range of 12–20 bulls:100 cows.

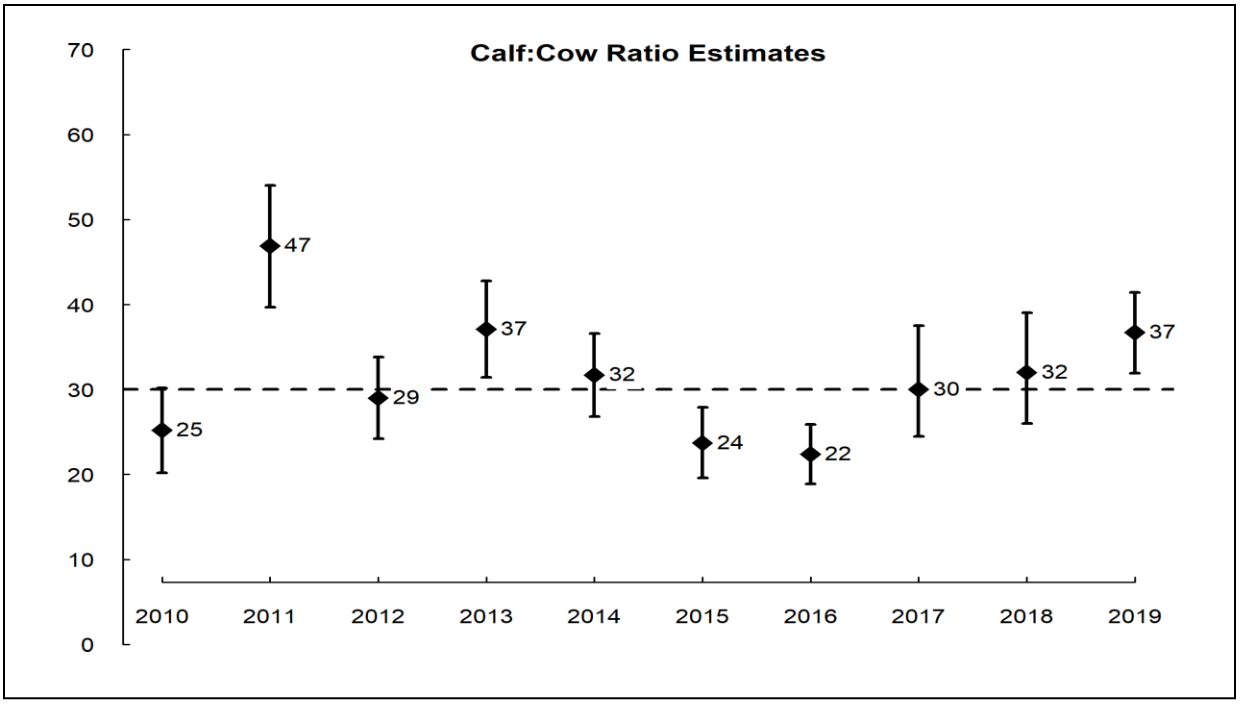

Figure 4. Estimates and associated 95% confidence intervals of post-hunt calf:cow ratios in the core range of the North Cascade elk herd (GMU 418 and Elk Area 4941), spring 2010-2019. The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth.

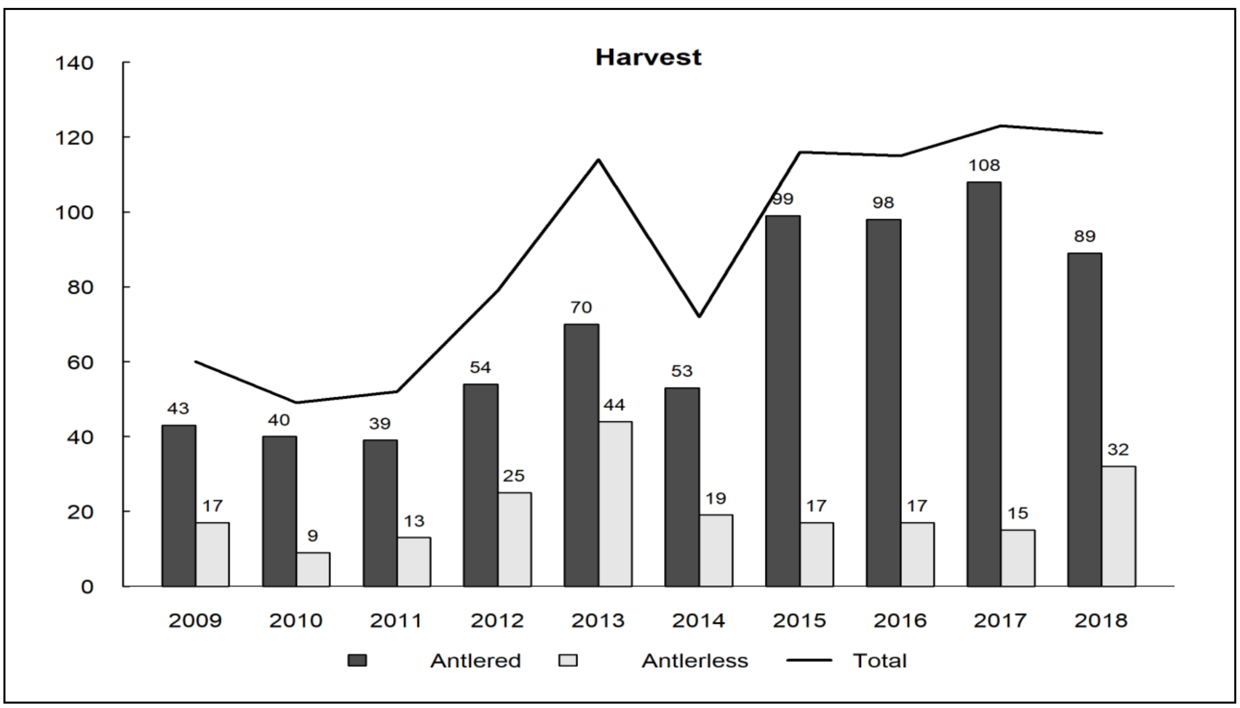

Figure 5. Estimated number of antlered and antlerless elk harvested in the North Cascade elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department and during established Tribal seasons, 2009-2018. Estimates of Tribal harvest were derived from annual harvest reports compiled by the Northwest Indian Fisheries Commission. Estimates do not include elk harvested in association with damage permits (see Human Wildlife Interaction below).

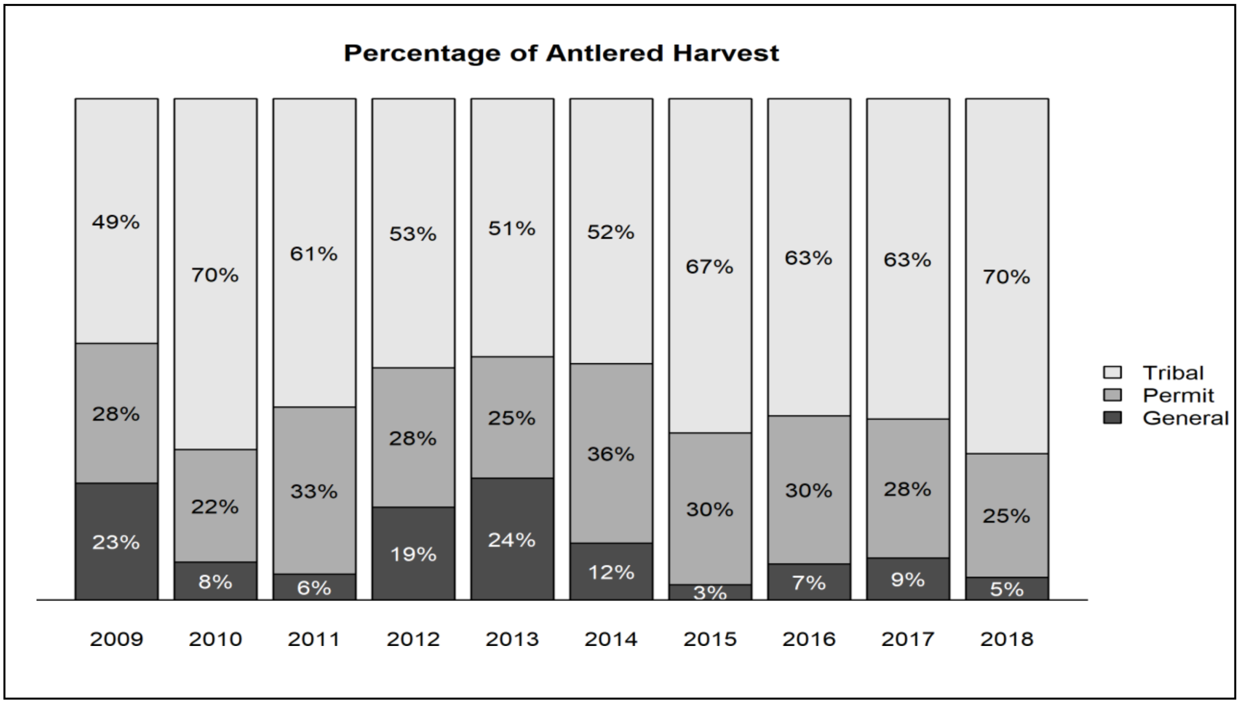

Figure 6. Estimated percentage of recreational antlered elk harvest in the North Cascade elk herd area that occurred during general and permit seasons and the percentage of harvest that occurred during established tribal seasons, 2009 -2018.

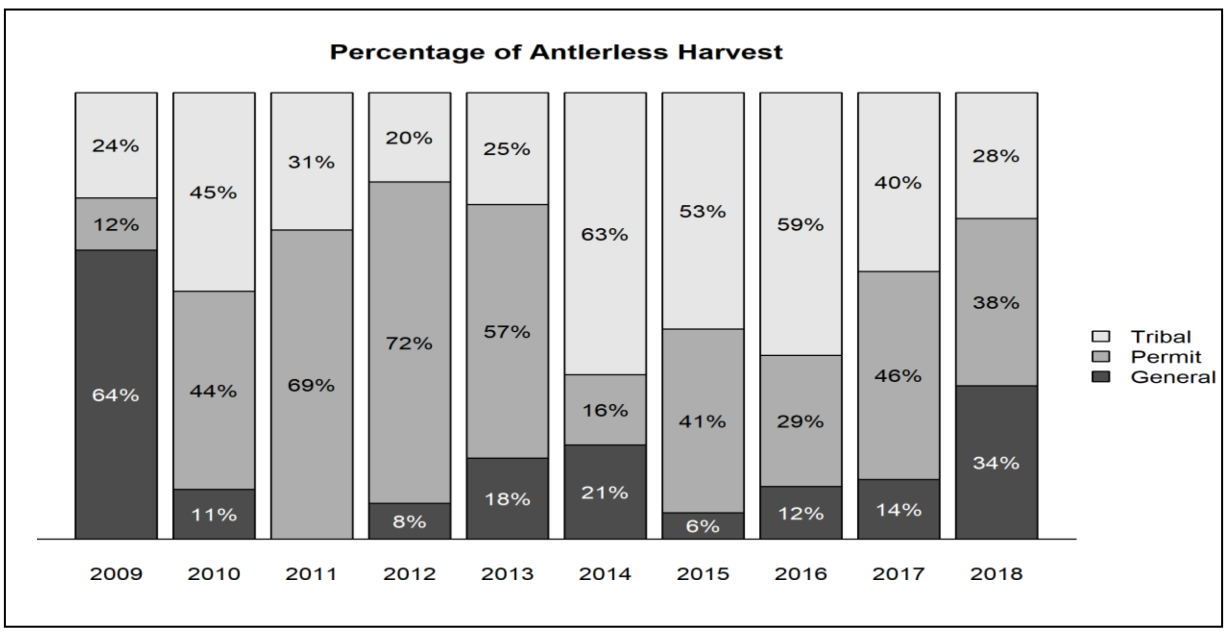

Figure 7. Estimated percentage of recreational antlerless elk harvest in the North Cascade elk herd area that occurred during general and permit seasons and the percentage of harvest that occurred during established tribal seasons, 2009 –2018.

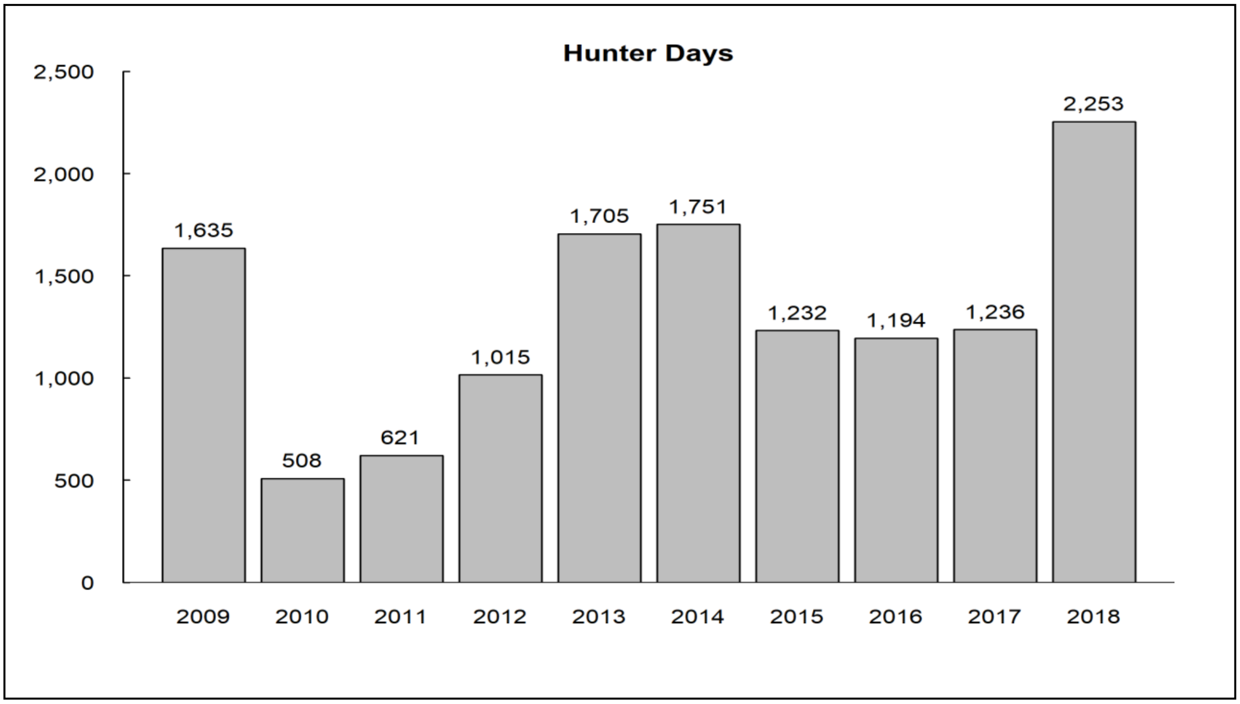

Figure 8. Estimated number of days hunters spent pursuing elk in the North Cascade elk herd area during recreational seasons that provided general, over-the-counter opportunities, 2009-2018.

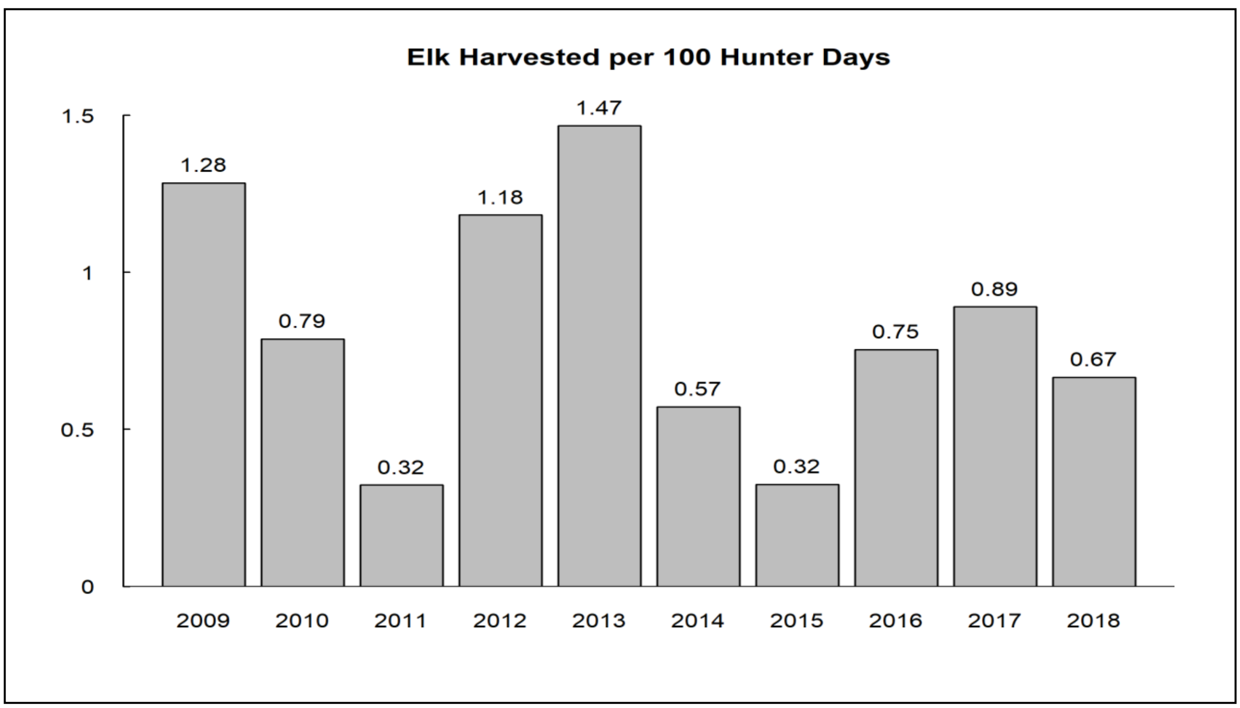

Figure 9. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the North Cascade elk herd area during recreational seasons that provided general, over-the- counter opportunities, 2009-2018.

Survival and Mortality

Common predators of elk that occur throughout the NCEH area include black bears and cougars. The Department has documented the presence of gray wolves in the upper Skagit River system near the U.S./Canada border since the early 1990s and collared a single wolf in Skagit County in 2017. In late 2018, the department documented the first wolf pack in western Washington in the modern era when an unknown wolf paired with the collared wolf to form the two-member Diobsud Creek pack (WDFW et al. 2019).

Although biologists have never documented a substantial winter effect on elk survival, it can influence the distribution of this herd. When severe winter conditions persist, elk become concentrated in low-elevation areas, including the Skagit River Valley, where the potential for conflict with agricultural producers is high.

The Department monitored the survival of adult female elk and branch-antlered bulls in the NCEH area 2005-2011 and estimated annual survival rates to be >0.90 for both sex classes prior to the reinstatement of harvest opportunities in 2007 (McCorquodale et al. 2011). Following the resumption of opportunities to harvest bulls, we estimated survival of branch-antlered bulls to be 0.68 (95% CI = 0.50–0.82). In addition, of the 270 mortality events we documented during that study, we attributed 77% to harvest-related causes, 14% to elk-vehicle collisions, and only 4% to natural causes (e.g., predation, disease, accidents, etc., combined).

Habitat

Forest management practices on private industrial and state forestlands continue to benefit the NCEH by creating a mosaic of habitat types. Specifically, clearcuts and young regenerating stands provide a forage base that is commonly absent in mature forests. However, a large portion of the NCEH area is under federal ownership and dominated by mature timber that provides little benefit to elk.

Human-Wildlife Interaction

The damage removal period for deer and elk ran from July 1, 2018 thru March 31, 2019. During that time period, WDFW received 48 elk-related complaints with a majority of complaints involving agricultural land. The remainder came from individuals not engaged in agricultural or livestock production (i.e., trees, gardens, landscaping, etc.)

A total of 66 elk damage permits were issued during 2018-2019 to address elk damage in GMUs 407, 418, and 437. The majority of the damage permits were focused in Elk Area 4941 during the state authorized removal period. Of the issued damage permits, 50 elk were harvested.

Research

No formal research was conducted by the Department on the NCEH during 2018. The Department has assisted the Point Elliott Treaty Tribes in using Clover traps to capture and collar elk, with application of VHF and GPS/Satellite collars to track elk movements, and for use in population monitoring. In 2018, 3 elk were captured, collared, and released.

Management Concerns

Treponeme-associated hoof disease

The Department confirmed the presence of Treponeme-associated hoof disease (TAHD) in the NCEH area in 2016. One confirmed case occurred in the Skagit River Valley, while the other confirmed case occurred near the town of Acme. TAHD of elk results in abnormal hoof growth, cavitating sole ulcers, and in severe cases, eventual sloughing of the hoof capsule. Elk severely affected by TAHD often have reduced mobility and condition. Consequently, it seems reasonable to assume they would have a reduced probability of survival or reproductive potential. However, it is unknown how TAHD affects the population dynamics of herds where it occurs. The Department is currently investigating the effects of TAHD on elk population dynamics in the Mount St. Helens elk herd area, as well as conducting research to better estimate the distribution and prevalence of TAHD. To learn more about the Department's efforts associated with investigating TAHD, please visit the Department's hoof disease webpage: https://wdfw.wa.gov/species-habitats/diseases/elk-hoof.

Management Conclusions

Estimates of total elk abundance and calf:cow ratios within the core herd area indicate the NCEH has steadily increased since 2007 and that calf recruitment rates have been at levels that would promote population growth or stability in most years. In addition, estimated bull:cow ratios and recent estimates of bull survival indicate the Department is exceeding its objective of maintaining 12-20 bulls:100 cows and an annual survival rate of 0.50 for bulls. Consequently, in the absence of abnormal weather conditions or exceedingly high harvest rates for adult female elk, the Department expects the NCEH to continue to increase.

Literature Cited

McCorquodale, S., S. Knapp, M. Davison, J. Bohannon, and C. Danilson. 2011. A population assessment for the North Cascades elk herd: 2006–2011. Washington Department of Fish and Wildlife, Olympia, WA.

McCorquodale, S. M., S. M. Knapp, M. A. Davison, J. S. Bohannon, C. D. Danilson, and W. C. Madsen. 2013. Mark-resight and sightability modeling of a western Washington elk population. Journal of Wildlife Management 77:359–371.

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

Washington Department of Fish and Wildlife. 2018. North Cascade Elk Herd Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA. USA. 35 pp.

Washington Department of Fish and Wildlife, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Washington Department of Fish and Wildlife, Ellensburg, WA, USA.

North Rainier Elk Herd

MICHELLE TIRHI, Wildlife Biologist
MIKE SMITH, Wildlife Biologist

Introduction

The North Rainier elk herd area is located in west-central Washington and consists of 8 GMUs, which includes 454 (Issaquah), 460 (Snoqualmie), 466 (Stampede), 485 (Green River), 490 (Cedar River), 652 (Puyallup), 653 (White River), and 654 (Mashel) (Figure 1). Elk are primarily found only in the eastern halves of GMUs 454 and 652. The primary land use of the North Rainier herd area is forest, accounting for nearly 50% of the total area. These lands occur in the eastern portion of the herd area and dominate the landscape in GMUs 460, 466, 485, 490, 653, and 654. Developed lands make up more than 25% of the herd area. Undeveloped lands, which include designated open space, exceed 10%, but are largely intermingled with developed land. A relatively small amount of agricultural land is found scattered in the eastern parts of GMUs 454 and 652.

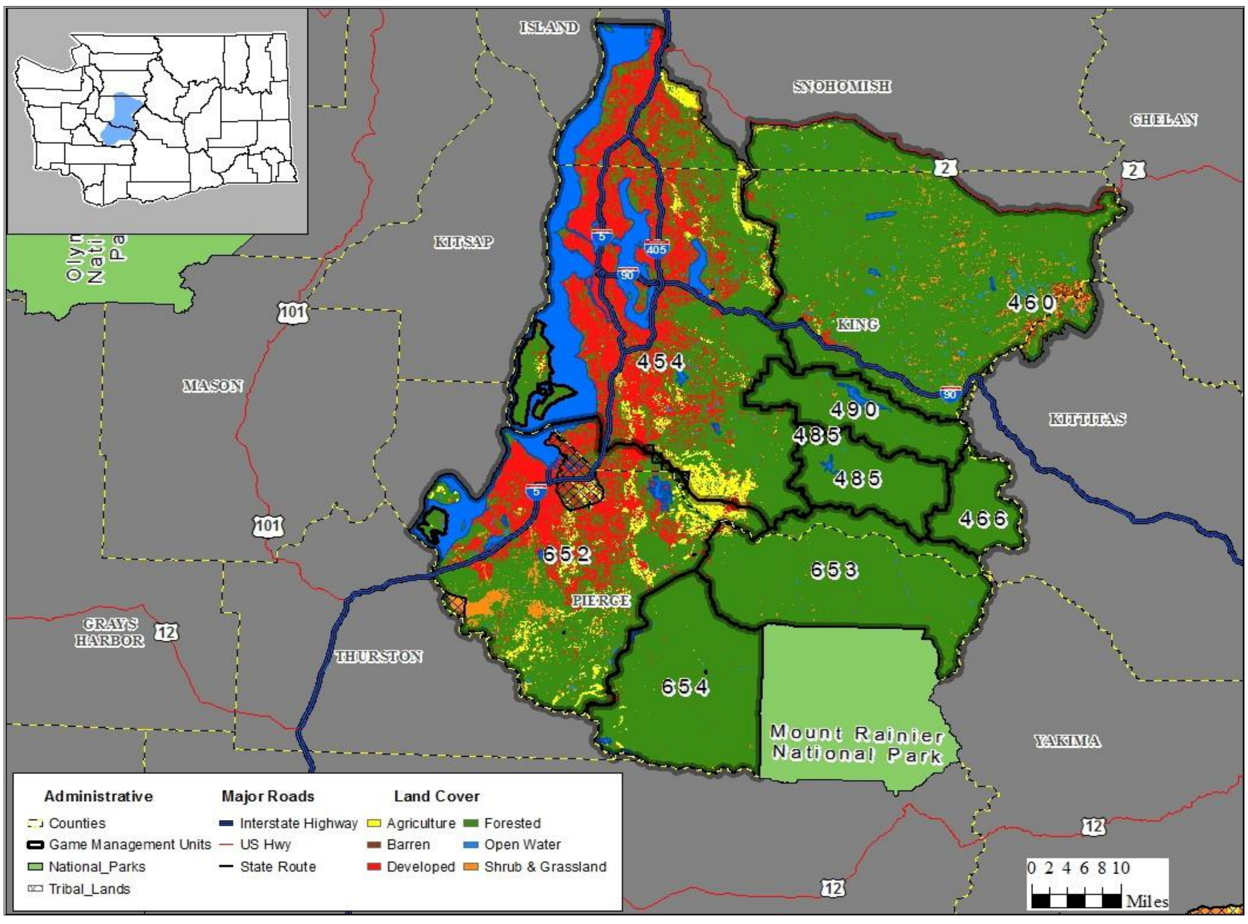

Figure 1. Dominant land use cover types within the 8 game management units that comprise the North Rainier elk herd area.

Management Guidelines and Objectives

The Department is currently updating the North Rainier Elk Herd Plan (WDFW 2002). Population objectives for the updated plan are in development at the time of this writing. Management objectives include developing a survey protocol(s) for the herd by 2025; maintaining a herd size of 4,850 elk; maintaining a minimum post-hunt population with a bull:cow ratio of 12-20 bulls:100 cows; reducing elk-caused damage complaints on private lands; reducing elk vehicle collisions; increasing opportunities to view elk; and continuing to partner with tribes on co-management of the herd. Calf:cow ratios are also monitored as indicative of herd dynamics and a ratio of 30:100 indicates a herd that is potentially stable while anything above that indicates a herd that is potentially increasing.

Population Surveys

A formalized monitoring program to estimate elk abundance for the entire herd area will be piloted in 2020. Currently, there are several monitoring efforts that occur within the herd area at smaller scales. The Muckleshoot Indian Tribe (MIT) conducts aerial composition surveys in GMU 653 and annually estimates elk abundance using mark-resight, in addition to estimating post-hunt sex and age ratios. Surveys typically only occur in the eastern half of the GMU, so estimates of abundance are not reflective of the entire GMU. However, the western half of the GMU was also surveyed in 2012, 2015, and 2017 with few elk observed. This supports the conclusion that the eastern GMU survey area contains the majority of elk (MIT and WDFW unpubl. data).

MIT estimated elk abundance in GMU 653 to be 1,257 (95% CI = 945–1,569) elk in spring 2017. Resulting estimates of post-hunt bull:cow and calf:cow ratios were 17:100 (95% CI = 13–21) and 25:100 (95% CI = 19–30), respectively (MIT unpubl. Data; Figures 2-4). Estimates of elk abundance steadily increased 2007-2012 but have been stable 2013-2017. Estimates of post-hunt bull:cow ratios have been relatively stable since 2011 and generally within targeted range, while estimates of post-hunt calf:cow ratios have generally been high indicating population stability and likely growth. MIT estimated elk abundance and post-hunt ratios within GMU 653 during spring 2018, but data were not available at the time of this writing. However, resulting estimates did indicate a stable population and adequate recruitment of calves.

MIT also conducts annual aerial composition surveys and uses mark-resight to estimate elk abundance in GMU 485. They estimated elk abundance to be 718 (95% CI = 584–852) elk in spring 2019. Resulting estimates of post-hunt bull:cow and calf:cow ratios were 16:100 (95% CI = 11–20) and 32:100 (95% CI = 25–40), respectively. Estimates of elk abundance have steadily increased since 2007 (Figure 5). Estimates of post-hunt bull:cow ratios have varied but have consistently been within objective (Figure 6). Estimates of post-hunt calf:cow ratios have also varied but have generally been at or above levels that should promote population stability (Figure 7).

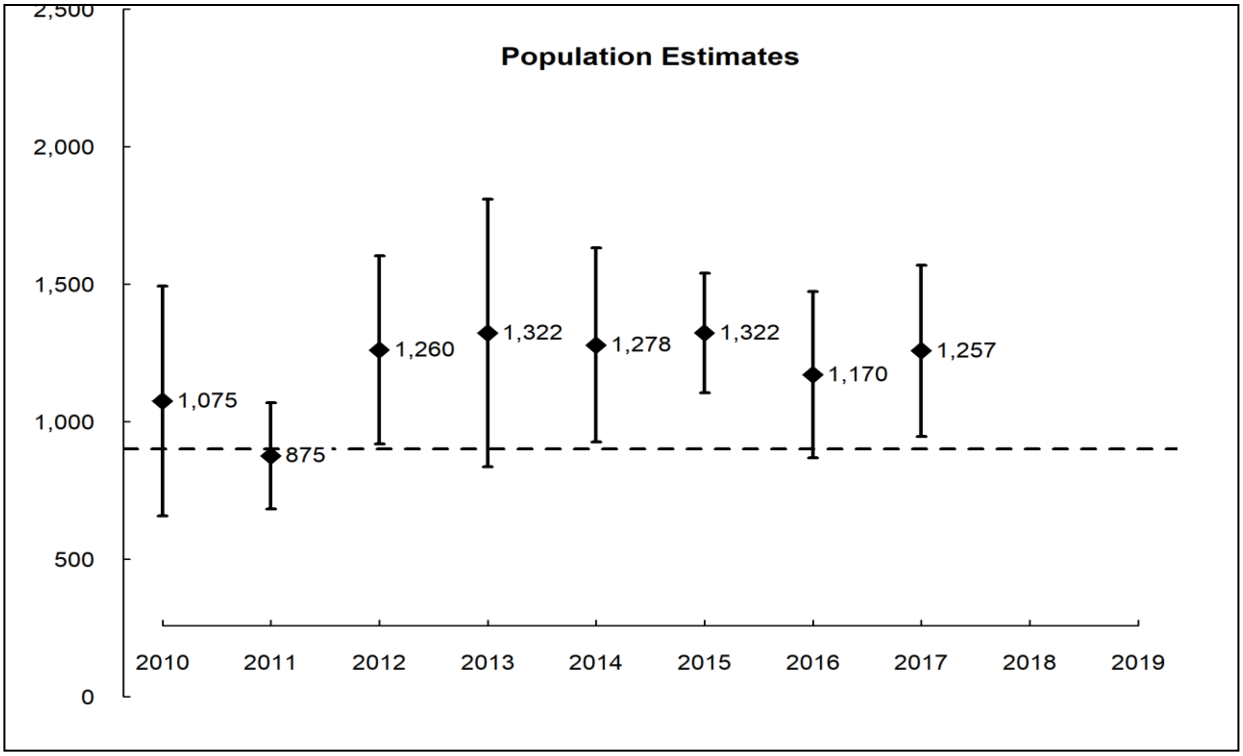

Figure 2. Mark-resight estimates of total elk abundance with associated 95% confidence intervals in GMU 653, spring 2010-2017 (MIT unpubl. data). The dashed line represents the 2002 management objective for total elk abundance (900 elk) for GMU 653 that will increase when the updated North Rainier Elk Herd Plan is adopted.

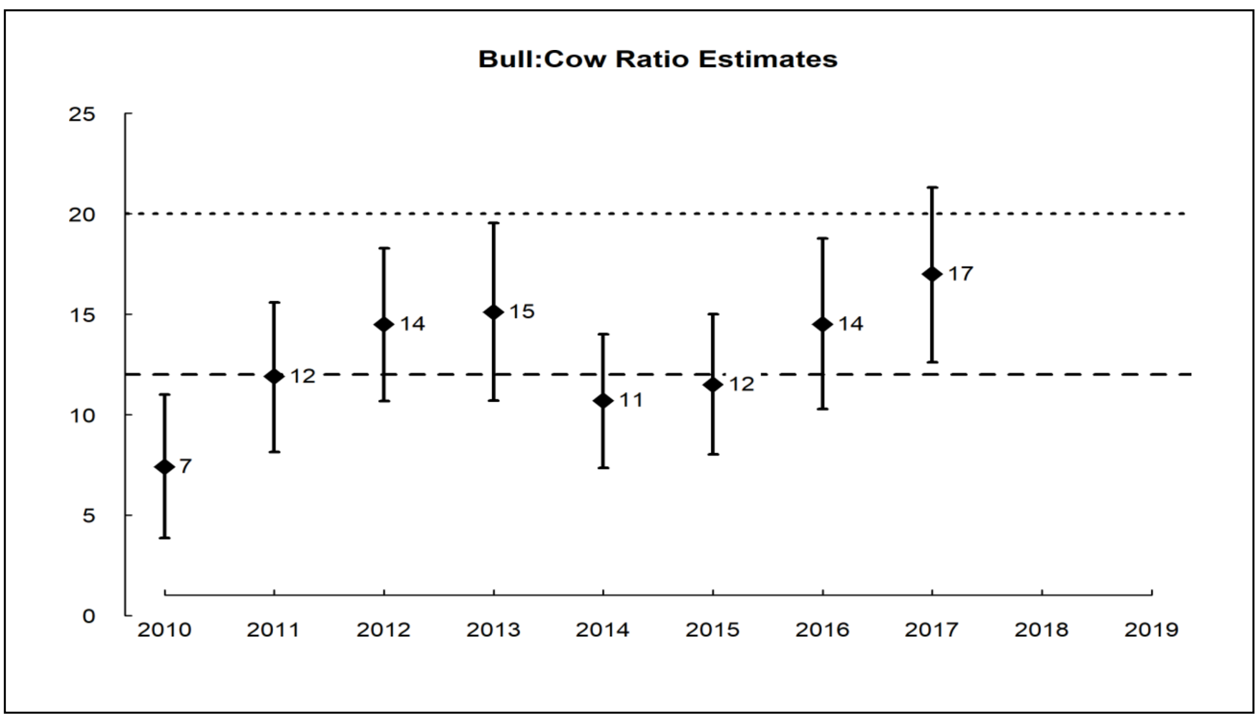

Figure 3. Estimates and associated 95% confidence intervals of post-hunt bull:cow ratios in GMU 653, spring 2010-2017 (MIT unpubl. data). The dashed lines represent the objective range of 12-20 bulls:100 cows.

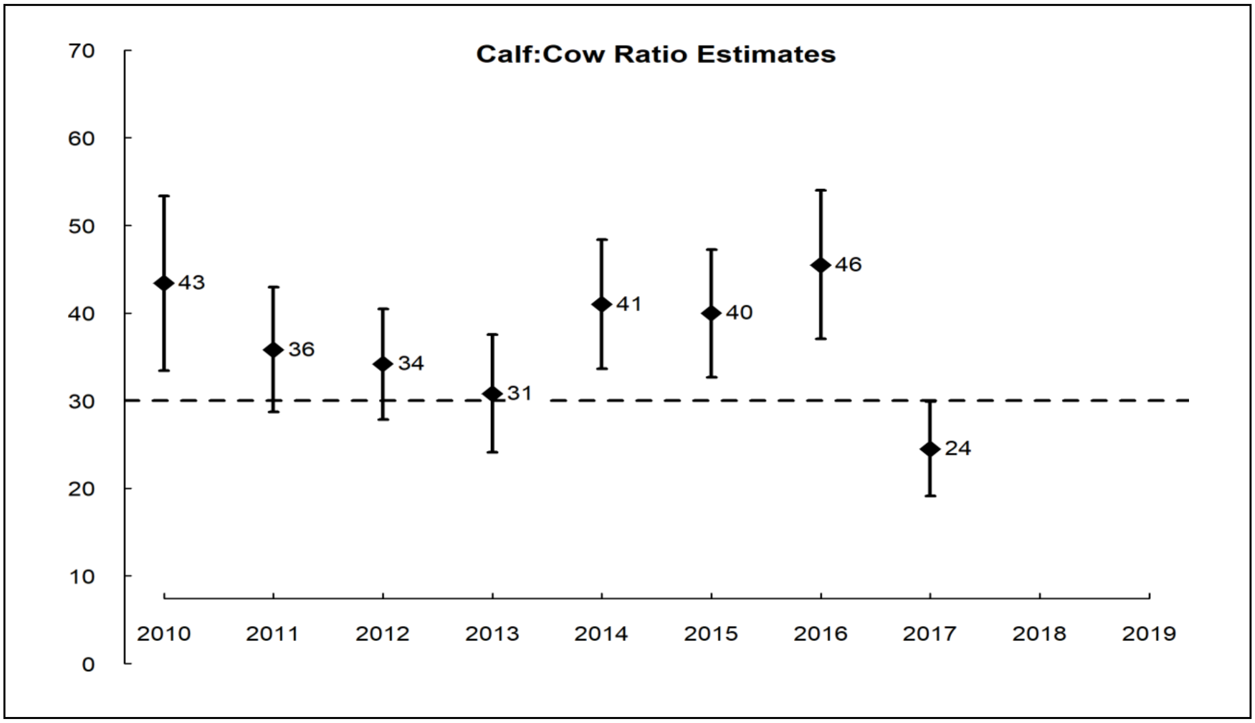

Figure 4. Estimates and associated 95% confidence intervals of post-hunt calf:cow ratios in GMU 653, spring 2010-2017 (MIT unpubl. data). The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth.

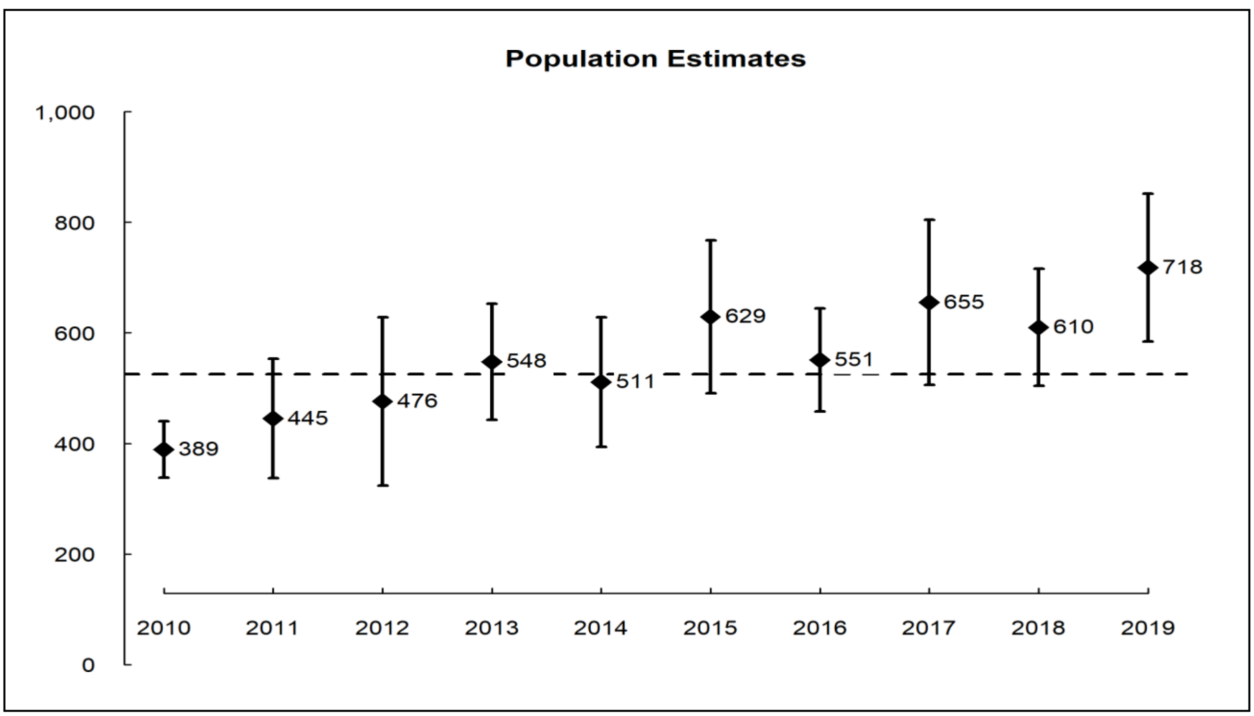

Figure 5. Mark-resight estimates and associated 95% confidence intervals of total elk abundance in GMU 485, spring 2010-2019 (MIT unpubl. data.). The dashed line represents the 2002 management objective for total elk abundance (525 elk) that will likely change when the updated North Rainier Elk Herd Plan is adopted.

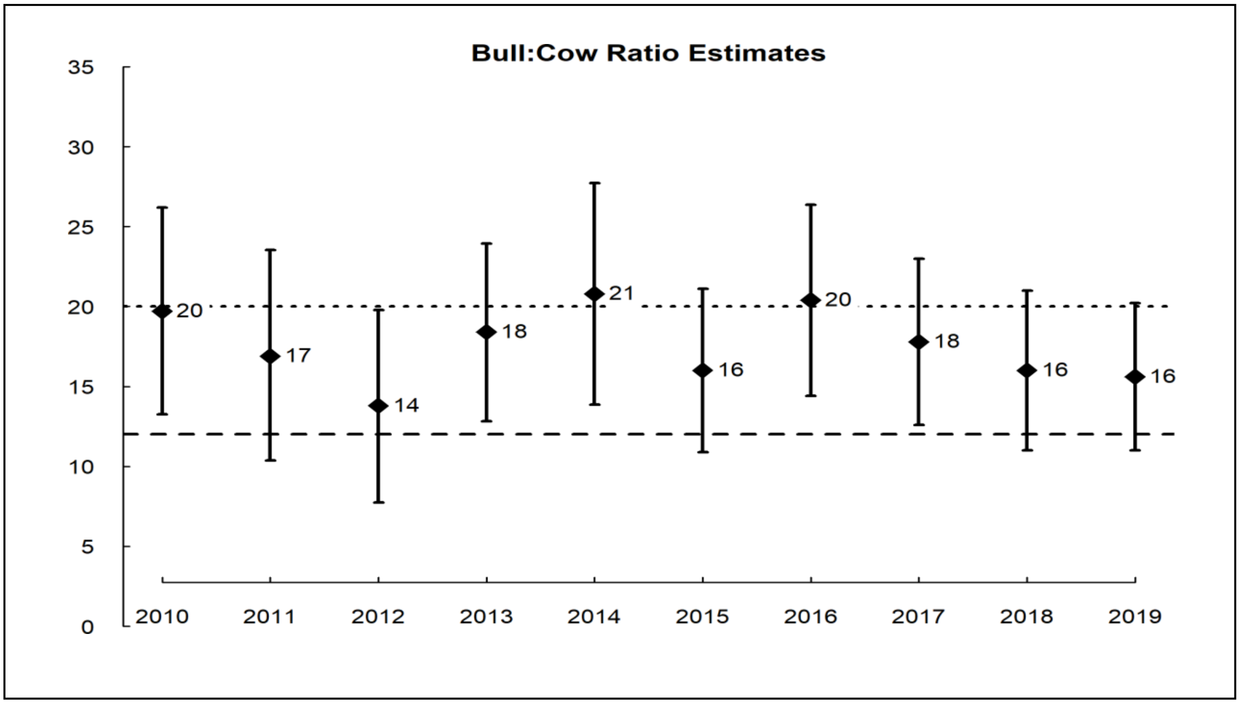

Figure 6. Estimates and associated 95% confidence intervals of post-hunt bull:cow ratios in GMU 485, spring 2010-2019 (MIT unpubl. data). The dashed lines represent the objective range of 12-20 bulls:100 cows.

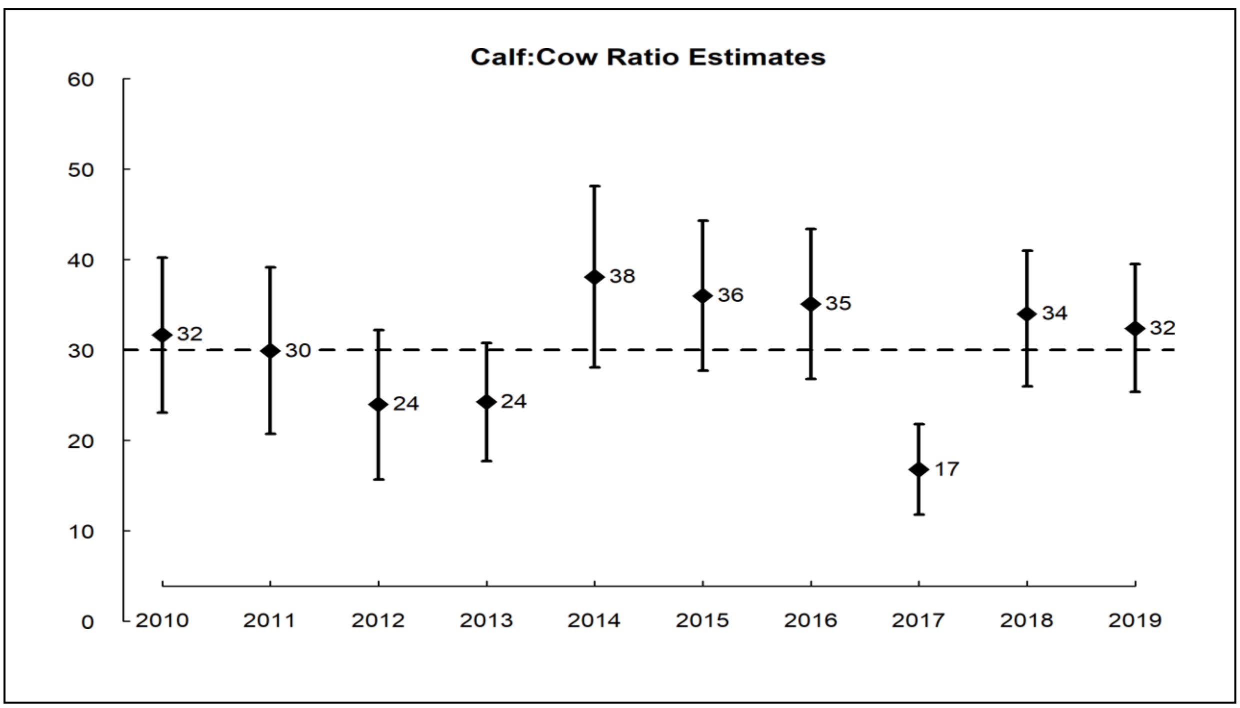

Figure 7. Estimates and associated 95% confidence intervals of post-hunt calf:cow ratios in GMU 485, spring 2010-2019 (MIT unpubl. data). The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth.

Other efforts to monitor elk abundance in the North Rainier elk herd area occur in Elk Areas 4601, 6013, and 6014 and Mount Rainier National Park. The volunteer-based Upper Snoqualmie Valley Elk Management Group (USVEMG) estimated elk abundance in Elk Area 4601 using ground-based mark-resight surveys 2010-2018. Estimates of elk abundance indicate elk numbers in Elk

Area 4601 have been relatively stable since 2010, except for a significant increase in 2018 (Figure 8). Both the USVEMG and WDFW don't believe this represents an actual increase in the elk population but is instead a function of the model used to estimate herd size.

WDFW in partnership with NW Trek and MIT launched a pilot citizen science elk monitoring project in Elk Areas 6013 and 6014 in 2015. A driving route with designated observation points was established and volunteers were trained to conduct monthly dusk or dawn surveys to record elk by sex and age and record observation location. A limited number of volunteers participated in this first year pilot but increased in 2016 and collected meaningful data. WDFW intends to work more closely with volunteers in the future and make slight alterations to the project criteria.

WDFW and MIT conducted a survey of Elk Area 6013 and 6014 combined in 2017 and located 192 elk in total with bull:cow and calf:cow ratios of 15:100 and 37:100, respectively (WDFW unpubl. data).

The Department has also collaborated with MIT, the U.S. Geological Survey, National Park Service, and Puyallup Tribe of Indians to estimate elk abundance in the subalpine meadows of Mount Rainier National Park (MRNP) (Griffen et al. 2013). Those surveys only include a small portion of the North Rainier elk herd, a group referred to as the White River elk. Although WDFW no longer participates in this survey, the partners continued to survey thru 2015 and used the model to estimate a population of 408 elk in the subalpine meadows of MRNP in 2015. Based on historical data from collared elk in the 1980s (WDFW unpublished data) about 15% of the White River elk did not migrate to higher elevations in the late spring while the remaining 85% migrated to high elevation areas in MRNP. More recently, studies conducted by MIT in 1998 indicated that about half of the White River elk migrate to MRNP while the remainder remain outside the park with some being non-migratory and some making short local migrations to nearby ridges.

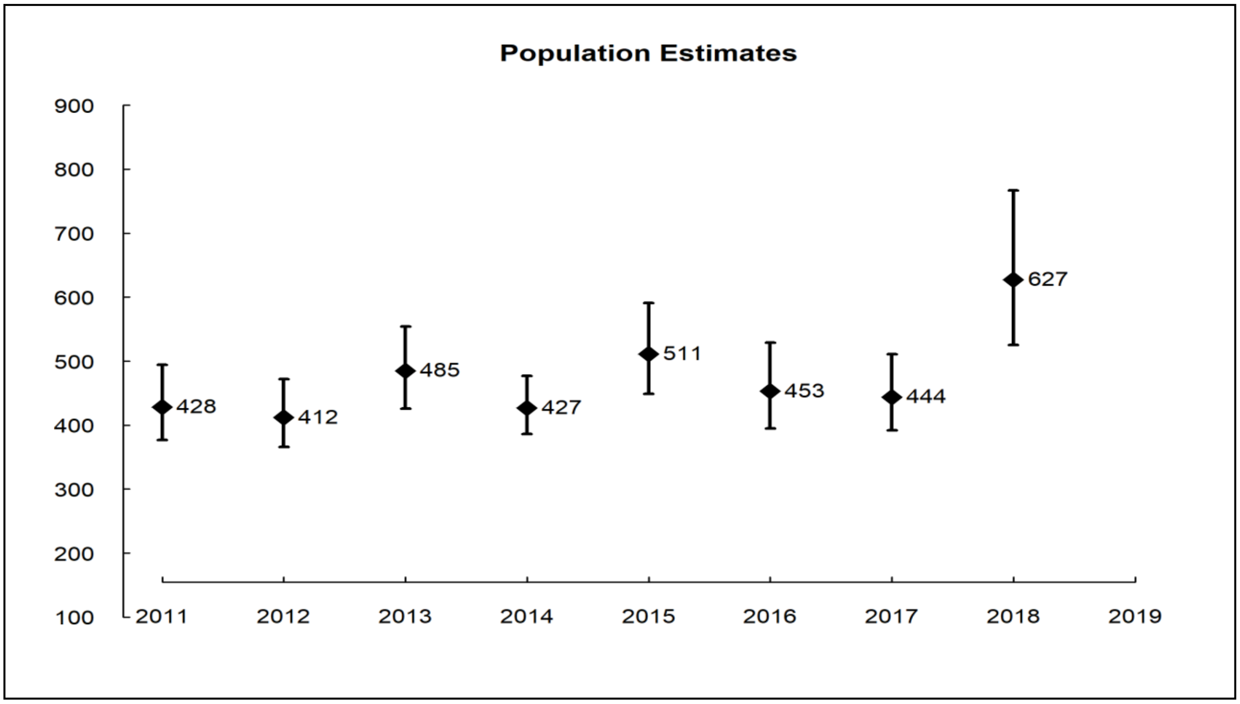

Figure 8. Mark-resight estimates and associated 95% confidence intervals of total elk abundance in in Elk Area 4601, spring 2011–2018.

Hunting Seasons and Recreational Harvest

The Department limits most general season harvest opportunities in the North Rainier elk herd area to branch-antlered bulls and offers most opportunities to harvest antlerless elk through the special permit system. However, limited opportunities to harvest antlerless elk during general seasons do occur during general archery and muzzleloader seasons and in areas where the Department's objective is to maintain low elk numbers. The Department restricts all elk harvest in GMUs 485 and 653 to special permit only opportunities.

Estimates of harvest during general seasons and total State harvest (e.g., general and permit combined) in the North Rainier elk herd area have averaged 358 and 411 elk, respectively, 2009-2018 (Figures 9-11). Reported tribal harvest averaged 102, while estimates of Total Harvest (e.g., total state and tribal harvest) have averaged 514 elk. All three harvest estimates increased 2009-2018. Eighty percent of the antlerless harvest within the herd area occurs during the general season (Figure 11). Hunter effort steadily increased, 2009-2018, while CPUE has trended upwards since 2012 (Figures 12 and 13).

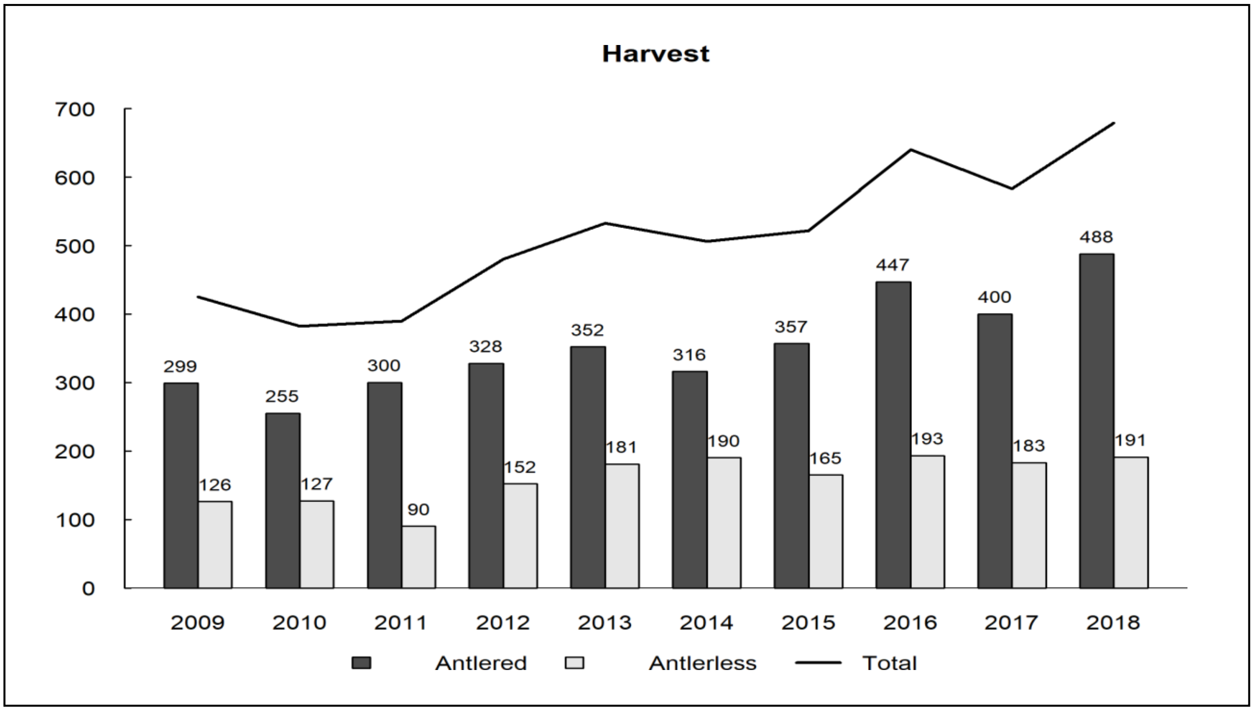

Figure 9. Estimated number of antlered and antlerless elk harvested in the North Rainier elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department and during established Tribal seasons, 2009-2018. Estimates of Tribal harvest were derived from annual harvest reports compiled by the Northwest Indian Fisheries Commission. Estimates do not include elk harvested in association with damage permits (see Human Wildlife Interaction below).

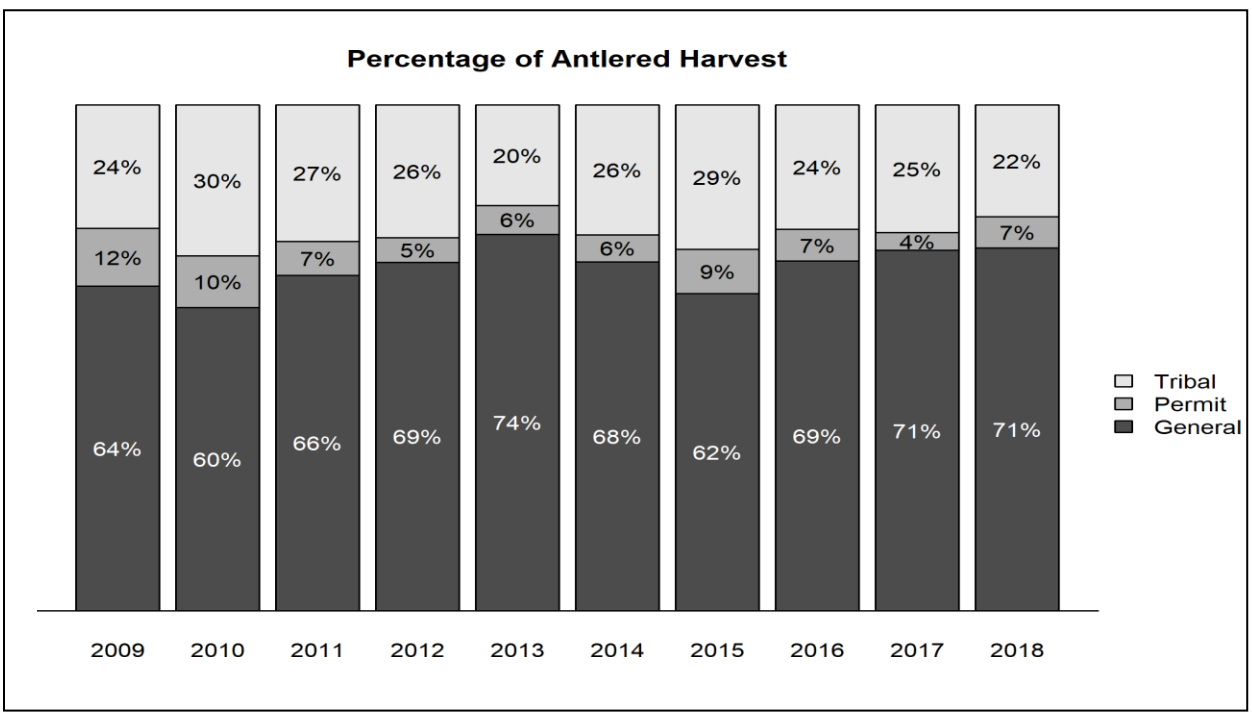

Figure 10. Estimated percentage of recreational antlered harvest in the North Rainier elk herd area that occurred during general and permit seasons and the percentage of harvest that occurred during established tribal seasons, 2009-2018.

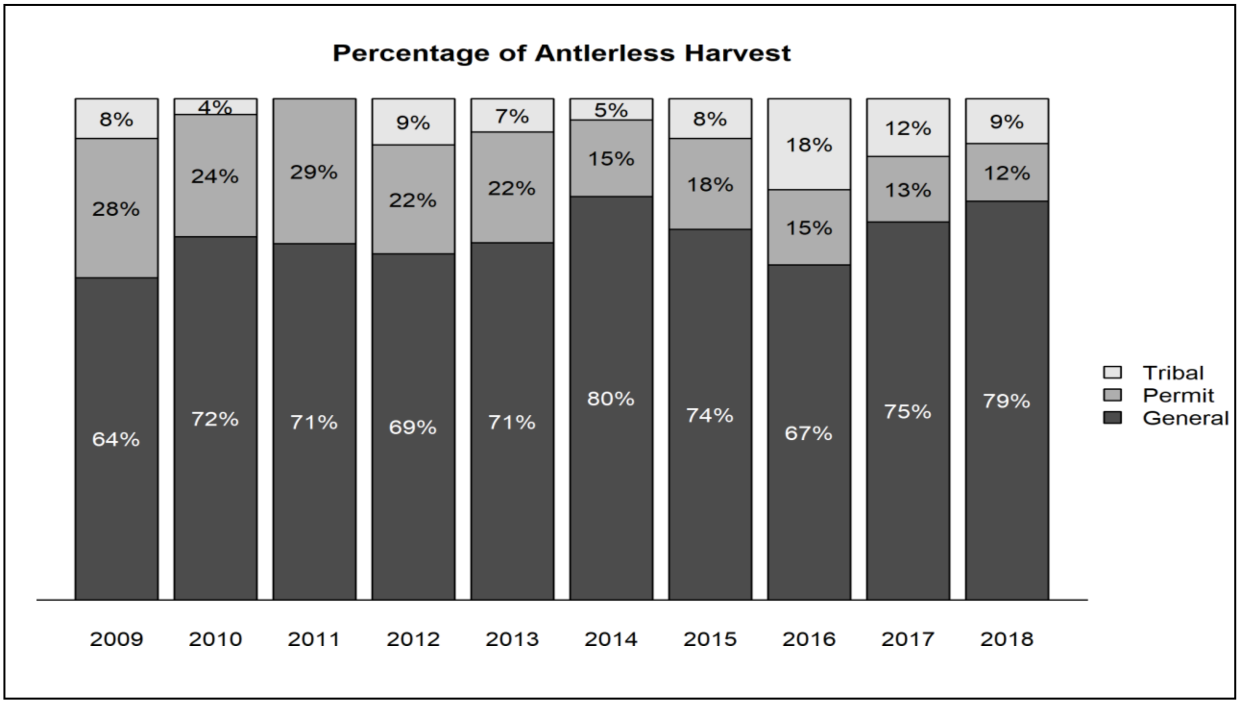

Figure 11. Estimated percentage of recreational antlerless harvest in the North Rainier elk herd area that occurred during general and permit seasons and the percentage of harvest that occurred during established tribal seasons, 2009-2018.

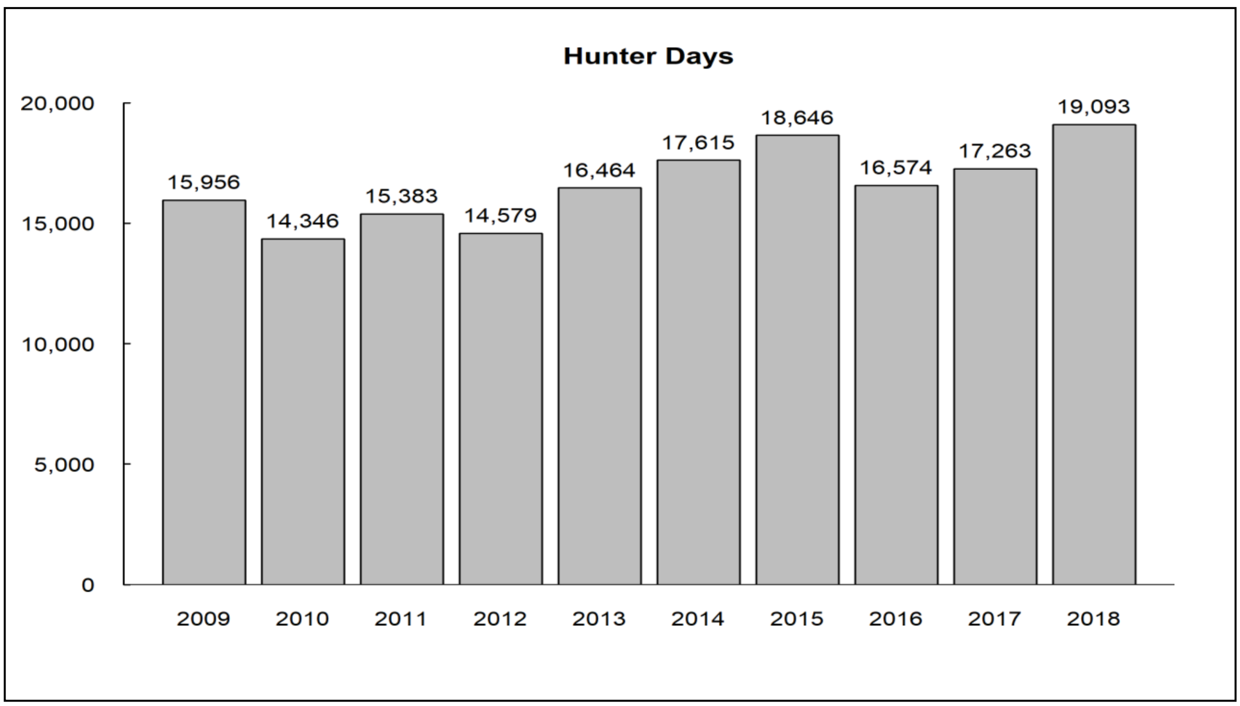

Figure 12. Estimated number of days hunters spent pursuing elk in the North Rainier elk herd area during recreational seasons that provided general over-the-counter opportunities, 2009-2018.

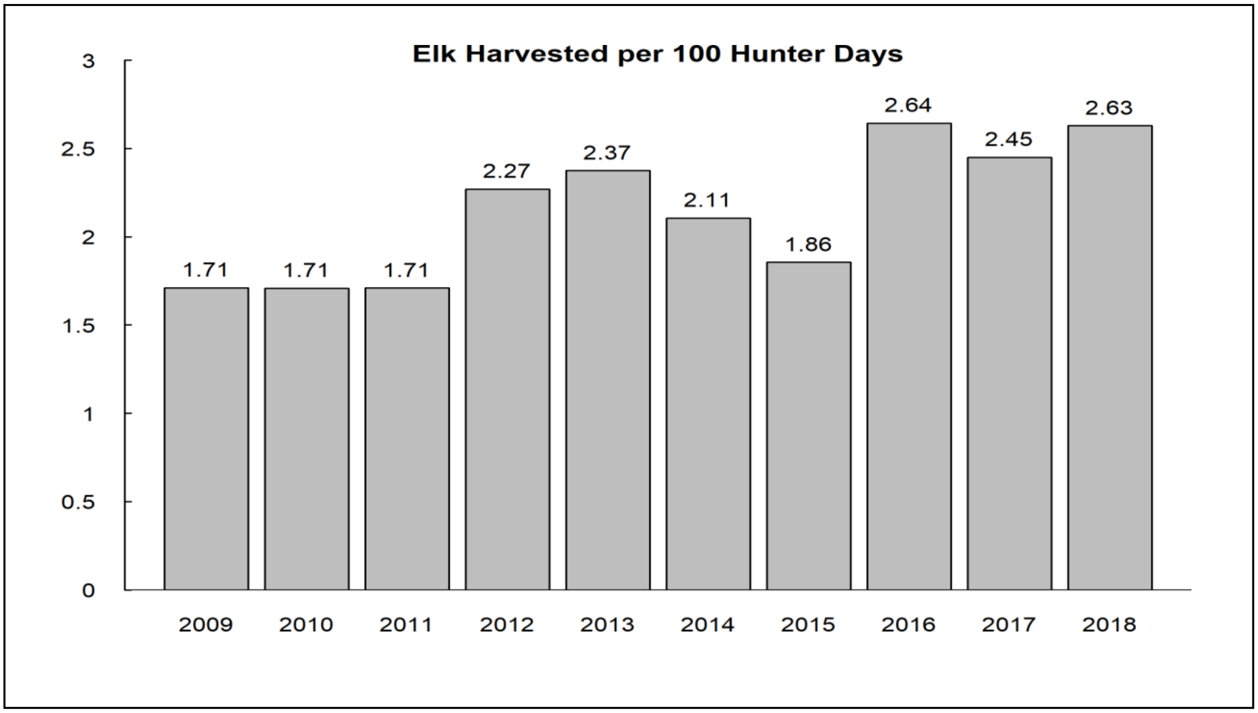

Figure 13. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the North Rainier elk herd area during recreational seasons that provided general over-the- counter opportunities, 2009-2018.

Treponeme-associated Hoof Disease (TAHD) in elk

Sporadic reports of lame elk or elk with overgrown or missing hooves have been received in southwest Washington since the mid-1990s. Reports of "hoof disease" have been increasing, and hunters have regularly seen and sometimes harvested elk with this condition. At times, observers have reported many individuals in a group limping and showing signs of hoof disease, which has been noted in males and females and old and very young animals. TAHD has been confirmed in at least one sample submitted from the North Rainier Elk Herd range and several more are suspect. For more information on Elk Hoof Disease, please visit the WDFW website: https://wdfw.wa.gov/conservation/health/hoof_disease/

Survival and Mortality

Common predators of elk that occur throughout the North Rainier elk herd area include black bears and cougars. At the time of this writing, there were no documented wolf packs within the herd area (WDFW et al. 2019) although WDFW staff are monitoring in response to various public reports (M. Tirhi, pers. comm.)

Severe winter conditions are rare in the North Rainier elk herd area and are unlikely to influence the population dynamics of this herd. However, extreme drought conditions that persist through summer and fall have the potential to reduce the availability of high-quality forages that elk need to accrue adequate fat stores for winter.

MIT has monitored the survival of adult female elk and calves in GMUs 485, 490, and 653, 1998-present (MIT unpubl. data). During that same period, they estimated annual adult female survival rates that were as low as 0.70-0.75 in some years, but typically ranged between 0.80-0.90. Cougars accounted for 63% and 33% of all adult cow mortalities in GMUs 485 and 653, respectively, prior to MIT implementing a cougar reduction program (see below) and 33% and 25%, respectively, following cougar removals.

Estimates of calf survival were quite variable and ranged from a low of 0.09 in 1999 to a high of 0.82 in 2006. Cougars accounted for 43-88% of all calf mortalities; bears only accounted for 6-11% of calf mortalities. Calf annual mortality rates due to cougar ranged 0.20-0.71. The lowest estimates of cow and calf survival from the MIT research occurred in the late 1990s and early 2000s and indicated cougars were the leading cause of mortality for both adult females and calves.

In response to these findings, MIT implemented a cougar reduction program from 2001 through 2007 with the goal of improving elk survival to the degree necessary for promoting population growth. Estimates of annual survival rates for cows and calves, and subsequently estimates of elk abundance, increased during that same period, which suggests cougar predation was a primary factor negatively affecting elk survival in these GMUs. Although the cougar reduction program seemingly benefited local elk numbers, it also occurred simultaneously with the implementation of more conservative hunting seasons and various habitat improvement projects, which also likely benefited elk. By 2018, female and calf survival was still occurring at levels that should promote elk population growth and stability (D. Vales, MIT, pers. Comm.).

Habitat

A large portion of the North Rainier elk herd area consists of lands administered by the USFS. The Huckleberry Land Exchange transferred over 9,000 acres of commercial timberland in the White River drainage to the USFS to be managed mostly as late successional reserve with minimal timber harvest. Restricting timber harvest reduces the amount of forest openings and can, in turn, reduce forage availability to elk and the number of animals a landscape can support. In response, the USFS created 400-500 acres of permanent openings to increase forage production for elk and deer in this area under the Greenwater Elk Forage Management Project (USFS 2008). In general, the North Rainier elk herd benefits most from forest management practices on private and state industrial forestlands, where frequent harvesting of mature timber creates a mosaic of early seral habitats that provide an important forage base for this herd.

Elk winter range is a priority habitat under the WDFW Priority Habitats and Species (PHS) Program. PHS is the principal means by which WDFW provides important fish, wildlife, and habitat information to local governments, state and federal agencies, private landowners, consultants, and tribal biologists for land use planning purposes. As such, Pierce County Planning and Land Services has adopted elk winter range as a Habitat of Local Importance within Title 18E.40. (Regulated Fish and Wildlife Species and Habitat Conservation Areas). Land use development permits within mapped elk winter range are regulated by the county under four management goals: 1) minimize human activity that would disturb elk, 2) maximize retention of undisturbed vegetation – particularly forest cover, 3) avoid activities that serve to exclude elk, and 4) protecting private property.

Human-Wildlife Interaction

Elk damage to ornamental shrubs, gardens, crops, and pastures is a problem in all of the GMUs to some degree, and complaints are received every year. Wildlife Conflict specialists work closely with agricultural producers by developing Damage Prevention Cooperative Agreements (DPCAs), which identify a plan to reduce damage incurred to 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 measures. WDFW Conflict Specialists and landowners use a variety of non-lethal methods, including electrified fladry fencing, noisemakers (bird-bangers, critter gitters, propane cannons), hazing and herding on foot, with a vehicle or dog, scarecrow-like electronic devices, and odor-based repellents such as Plantskyyd.

Lethal methods of deterring elk are also used to reduce damage to crops. These efforts include hunts within specified elk areas, pools of Master Hunters, as well as landowner damage permits. See Table 1 for a summary of permits issued to landowners allowing the taking of elk causing agricultural damage in the North Rainier Elk Herd during 2018-2019. Collectively, these hunts are designed to decrease the number of elk causing the damage and/or to haze elk from the area.

Table 1. Number of Permits to Lethally Remove Elk Causing Damage to Agricultural Crops and Resulting Kills, North Rainier Elk Herd, 2018-19.

Game Management Unit	DPCA's Issued	Permits Issued	Elk Removed
454	6	8	3
460	2	4	1
466	0	0	0
485	0	0	0
490	0	0	0
652	28	50	18
653	0	0	0
654	5	13	9
TOTAL	**41**	**75**	**31**

In GMU 460, elk damage is a notable problem for 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 have raised 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 personnel, and city and county staff. The primary role of the group is to address the problems associated with the herd. Further, Washington Department of Transportation has initiated monitoring and collaborative academic studies to examine vehicle-elk collisions along I-90. Researchers are examining elk use of corridors and movement patterns related to the use of corridors.

Additional elk hunting opportunities aimed at reducing private property damage were initiated in 2014 within Elk Area 4601 and in 2015 in Elk Area 6014. The harvest of antlerless elk was added to general season hunts, aimed at reducing the herd in these localized areas. Regional master hunter permits were also issued in 6014 to further curtail damage.

Elk in GMUs 485, 466 and 653 have largely not been a problem to private property owners with few nuisance complaints received. However, continued monitoring of herd growth and opportunities to track any emigration from these GMUs will be valuable as surrounding communities continue to expand and develop adjacent to core herd use areas.

Research

WDFW is a member of the White River Elk Herd Technical Committee comprised of state, federal, and tribal biologists and researchers who cooperatively manage the White River elk group. There is no collective partnership for the entire herd area. Members of the Committee collaborated on a Hybrid Double-observer Sightability Model for Aerial Surveys research project from 2008-2014 (Griffin et al. 2013). WDFW is not currently engaged in research in the North Rainier herd planning area.

Management Concerns

Currently, management decisions are based largely on hunter harvest and effort within the herd area. WDFW is contemplating a strategy to better understand herd size, population demographics, distribution, and trends but implementation will depend on funding. The work of MIT biologists and others has been helpful in this regard, but a more comprehensive assessment is needed. Elk conflicts with commercial agricultural production and other areas remains a concern in portions of the herd area. WDFW staff are currently developing an updated herd plan that will identify strategies to address these concerns and the resources needed to implement them.

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.

Elk in GMU 460 (outside Elk Area 4601) should continue to be managed for herd growth and expansion. Several sub-herds occur within and immediately adjacent to the urban boundaries of the cities of North Bend and Snoqualmie (Elk Area 4601). 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 and the Stampede sub-herd in GMU 485 and 466 include maintaining the population at a minimum of 600 elk and meeting or exceeding the statewide objective of 12-20 bulls:100 cows. The GMU 485 permit hunt is one of Washington's most popular because of the opportunity to harvest and view mature bulls coupled with 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.

Elk in GMU 652 and Elk Area 6014 should continue to be managed with liberal seasons and damage prevention permits designed to reduce damage to private property and agricultural crops. Harvest opportunity in Elk Area 6014, which composes a significant portion of GMU 652, was liberalized beginning in the 2014-15 season to allow either 3-point minimum bull or antlerless opportunity for modern firearm hunters and muzzleloaders and any elk for archers. Additionally, three separate winter permit hunts were initiated in 6014 each providing 10 permits. Finally, damage harvest permits (master hunters) and landowner kill permits should continue to be used to reduce property damage to acceptable levels.

The management goal for the White River and Mashel sub-herds in GMUs 653 and 654 is to increase populations and meet or exceed the statewide objective of 12-20 bulls:100 cows. The bull-only permit hunt initiated in 2006 in GMU 653 as a population recovery tool has become a very popular hunt due to the higher elevation, rugged terrain, limited hunter entry and large branched bulls available for harvest. Although the herd exceeded 2002 management plan recovery objectives in GMU 653 and this bull only permit hunt may no longer be needed as a recovery tool, the uniqueness and popularity of this hunt has justified maintaining it. Increasing elk numbers in GMU 654 must be done in a manner that allows minimizing crop damage by elk. The elk damage permit hunt opportunity will continue in the expanded Elk Area 6054, which should help control private property damage and provide additional recreational opportunity.

Literature Cited

Griffin, P. B. Lubow, K. Jenkins, D.Vales, B. Moeller, M. Reid, P. Happe, S. McCorquodale, M.Tirhi, J. Schaberl, K. Beirne. 2013. A Hybrid Double-Observer Sightability Model for Aerial Surveys. The Journal of Wildlife Management 77(8):1532–1544.

U.S. Forest Service. 2008. Greenwater Elk Forage Management Project Decision Memo. Mount Baker-Snoqualmie National Forest, Mountlake Terrace, WA.

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

Washington Department of Fish and Wildlife. 2002. North Rainier Elk Herd Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA.

Washington Department of Fish and Wildlife, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Washington Department of Fish and Wildlife, Ellensburg, WA, USA.

Olympic Elk Herd

BRYAN MURPHIE, Wildlife Biologist

Introduction

The Olympic elk herd area is located on the Olympic Peninsula, which consists of 14 GMUs, 601 (Hoko), 602 (Dickey), 603 (Pysht), 607 (Sol Duc), 612 (Goodman), 615 (Clearwater), 618 (Matheny), 621 (Olympic), 624 (Coyle), 633 (Mason), 636 (Skokomish), 638 (Quinault Ridge), 642 (Copalis), 648 (Wynoochee), and 651 (Satsop) (Figure 1). Much of the land utilized by elk in this area is in public ownership. Federal lands include over 922,000 acres in the Olympic National Park (ONP) consisting of the core of the Olympic Mountains proper, as well as portions of coastal areas along the Pacific coast. Olympic National Forest (ONF) lands adjacent to ONP include an additional 643,000 acres. The State of Washington, Department of Natural Resources, manages 368,000 acres of forest lands in the herd area, of which the 168,000-acre Clearwater Block is the largest. Indian Reservation lands encompass over 255,000 acres, the largest being 208,000 acres in the Quinault Indian Nation Reservation. The remainder of the land is in private residential, agriculture, or industrial timber company lands.

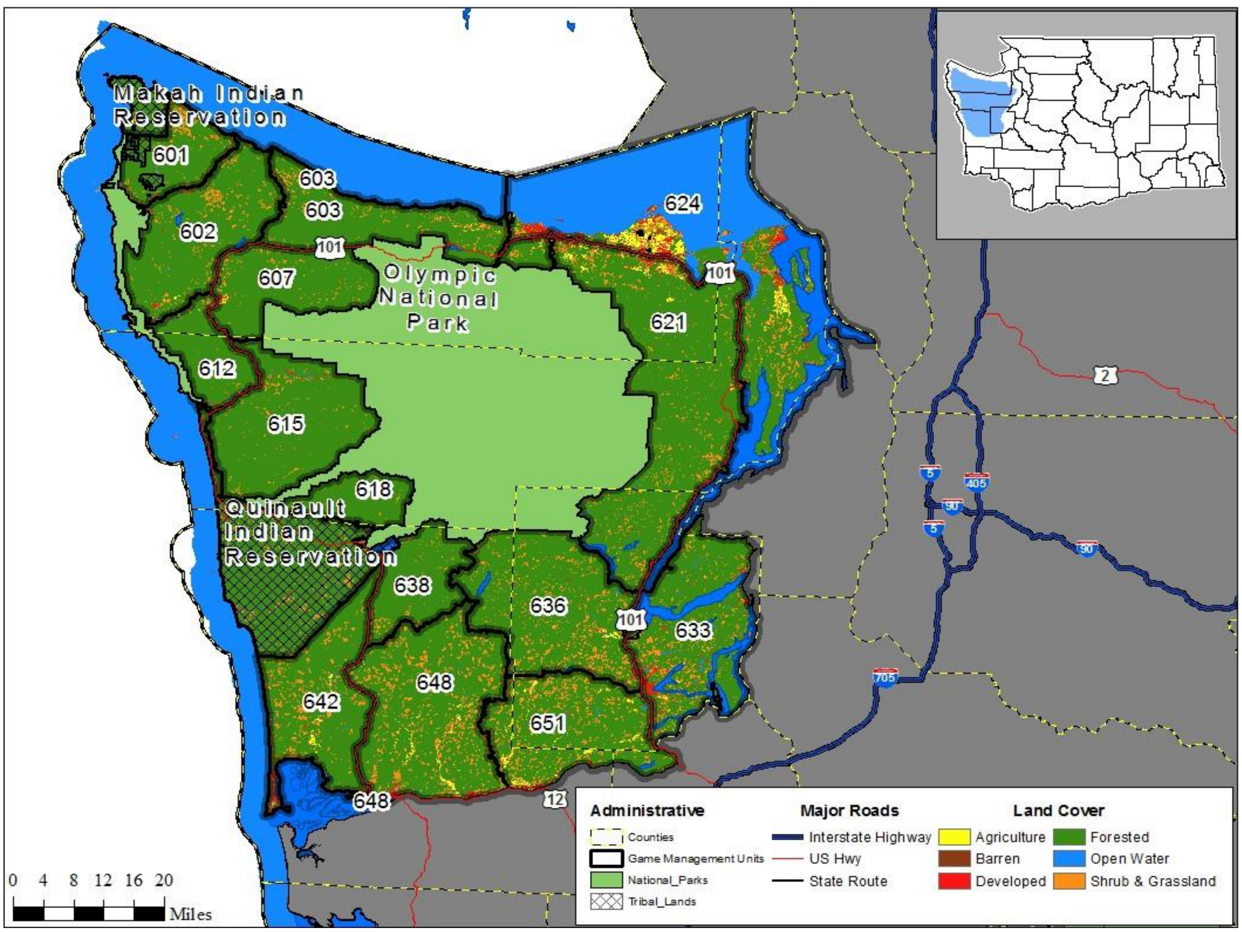

Figure 1. Dominant land use cover types within the 14 game management units that comprise the Olympic elk herd area.

Management Guidelines and Objectives

The Olympic Elk Herd Plan identifies a population objective of 11,350 elk outside Olympic National Park (WDFW 2004). However, that objective is likely to change when the plan is updated. The Department has not identified a formalized monitoring strategy to estimate elk abundance or composition throughout the herd area. Consequently, the Department generally manages for stable to increasing elk populations, while providing for multiple uses; including recreational, educational and aesthetic, as well as a sustainable annual harvest. Additional objectives include managing for a pre-season population with 15-35 bulls:100 cows and/or a post-hunt population with 12-20 bulls:100 cows (WDFW 2004) and maintaining an annual survival rate of 0.50 for bulls when bull mortality is monitored (WDFW 2014). We attempt to achieve these objectives largely through manipulating hunting seasons.

While the Department has defined objectives relating to herd abundance and acceptable ranges for bull:cow ratios, there are no established objectives for calf:cow ratios because most factors that affect calf survival can rarely be addressed through short-term management activities. In addition, the Department primarily collects age ratios to assess the likelihood for a herd to grow, remain stable, or decline. However, whether an estimated recruitment rate would result in a change in abundance also depends on the survival rate of adult female elk. This makes it difficult to identify the minimum calf:cow ratio needed to prevent population declines (Caughley 1974, Skalski et al. 2005). Nonetheless, survival of adult female elk in managed populations is typically > 0.85 and is often relatively constant (Raithel et al. 2007, Brodie et al. 2013), which means elk abundance usually has the potential to increase if calf:cow ratios in spring are ≥ 30 calves:100 cows. Thus, even though the Department does not establish management objectives for calf:cow ratios, we do prefer to see post-hunt ratios that are ≥ 30 calves:100 cows and become concerned when they are below 25 calves:100 cows in consecutive years.

Population Surveys

The Department and several Treaty Tribes that have hunting rights on the Olympic Peninsula and periodically conduct aerial or ground-based composition surveys in the Olympic elk herd area. Formalized estimators (e.g., sightability models, mark-resight, distance sampling, etc.) to correct observed data for detection probabilities that vary among age and sex classes are generally not applied. Even though those data are likely biased, and managers must make conservative inferences, it still provides some insight into the current composition of this herd.

Estimates of pre-hunt bull:cow ratios have been within management objectives most years from 2008 to 2018 (Figure 2). Estimates of post-hunt bull:cow ratios in 2018 and 2019 were within management objectives but were lower than objectives in some years since 2008 (Figure 3). Although often reported as below the management objective of 12-20 bulls:100 cows, these ratios are thought to be biased low, as post-hunt surveys are conducted in late winter with effort focused on the main cow and calf groups. This is also a period when most mature bulls are travelling independently or in small bachelor groups making them less detectable during survey flights. Estimates of post-hunt calf:cow ratios averaged 28:100 cows (range = 24:100 to 34:100) (Figure 4).

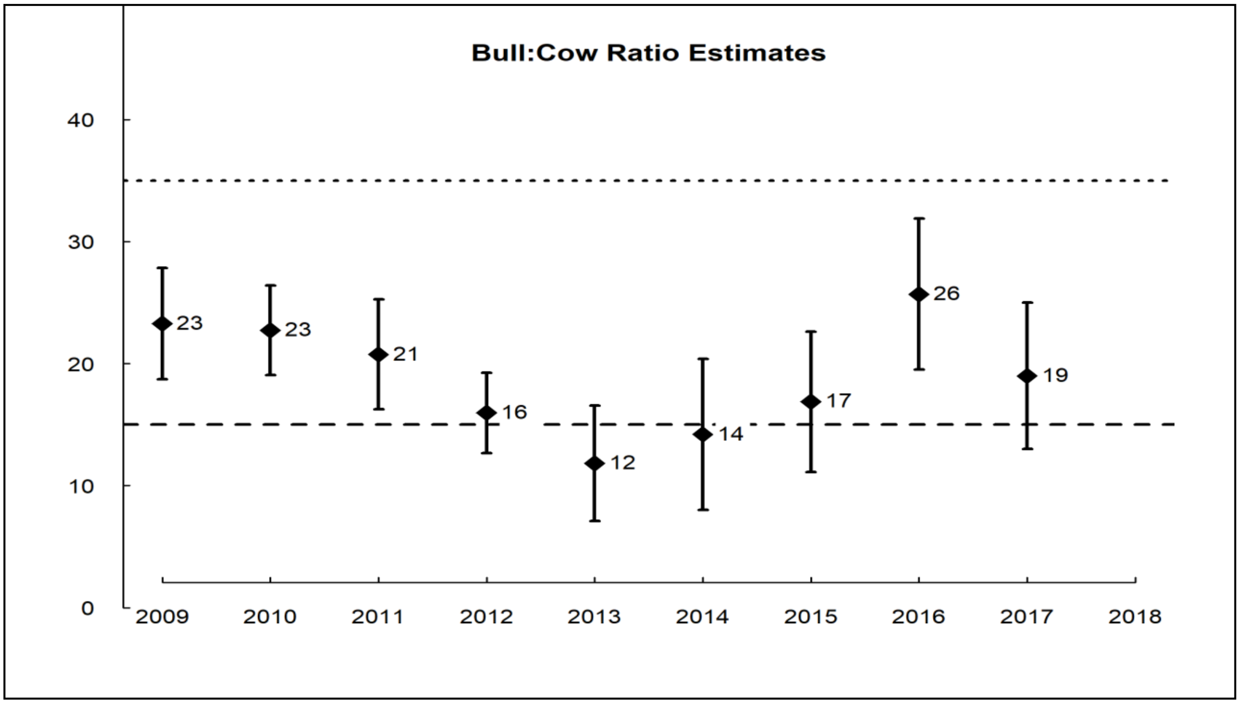

Figure 2. Estimates and associated 95% confidence intervals of pre-hunt bull:cow ratios in the Olympic elk herd area, autumn 2009-2018. The dashed lines represent the objective range of 15-35 bulls:100 cows.

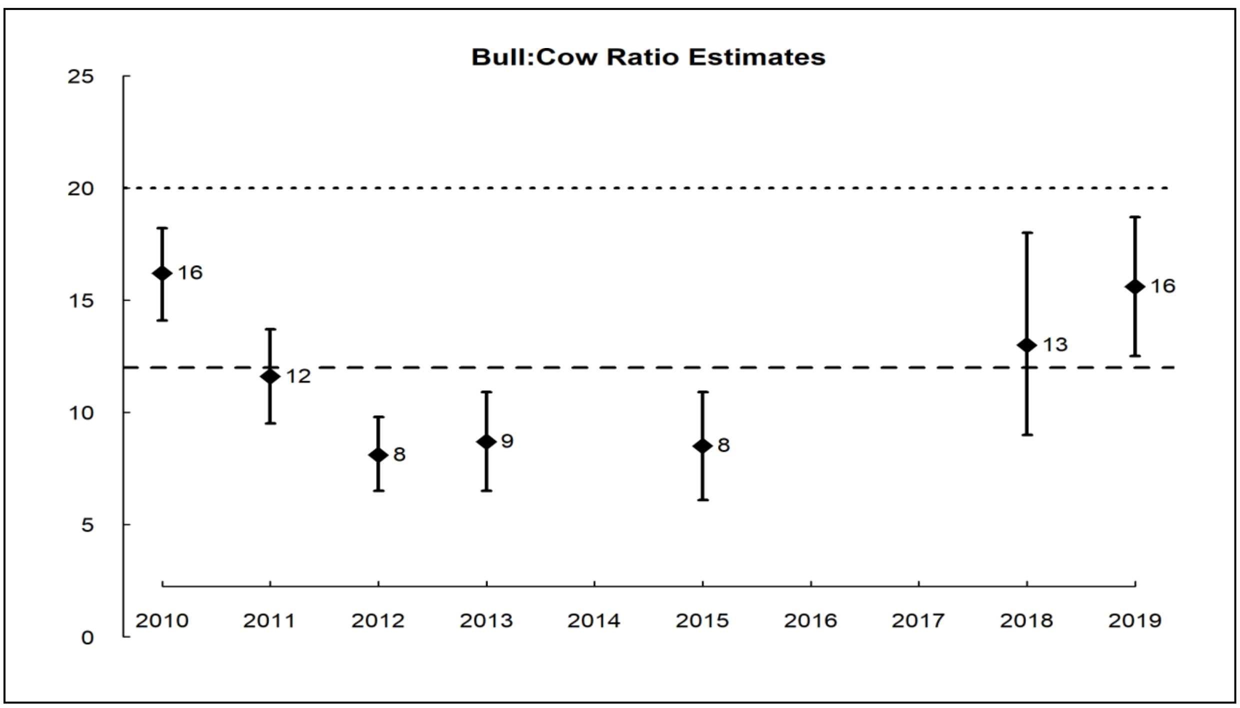

Figure 3. Estimates and associated 95% confidence intervals of post-hunt bull:cow ratios in the Olympic elk herd area, spring 2010-2019. The dashed lines represent the objective range of 12-20 bulls:100 cows. Post- hunt ratios from 2014, 2016, and 2017 are not included because biologists only conducted surveys in a single GMU during these years.

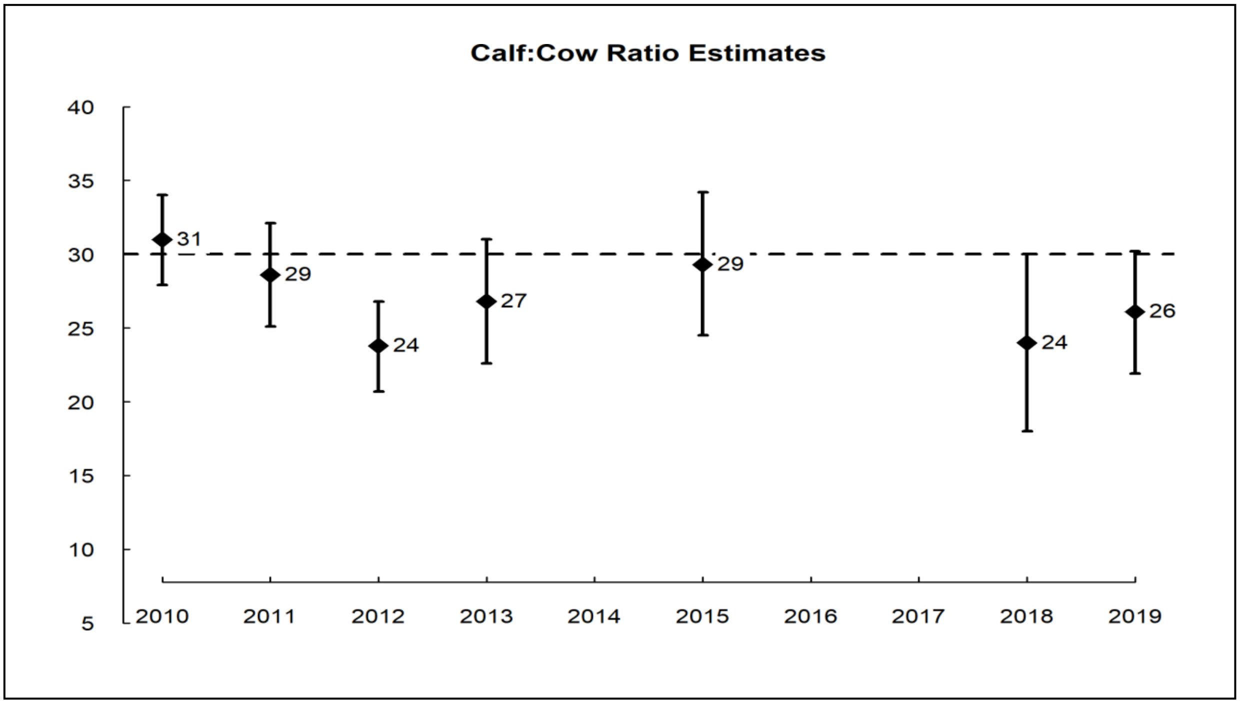

Figure 4. Estimates and associated 95% confidence intervals of post-hunt calf:cow ratios in the Olympic elk herd area, spring 2010–2019. The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth. Post-hunt ratios from 2014, 2016, and 2017 are not included because biologists only conducted surveys in a single GMU during these years.

Hunting Seasons and Recreational Harvest

The legal elk for most general season hunts in the Olympic elk herd area are 3-point minimum, branch-antlered bulls. Harvest opportunities for antlerless elk are offered during some general season archery hunts and through a special permit system. Antlerless harvest is usually targeted at areas where the Department’s objective is to maintain low elk numbers.

Estimates of harvest during general seasons and total State harvest have averaged 267 and 301 elk, respectively, 2009-2018; while estimates of harvest including tribal harvest have averaged 458 elk, 2009-2018. Elk harvest in 2018 was a period high for State hunters during 2009-2018 (Figure 5). State hunting typically accounts for a greater percentage of the bull harvest in the Olympic elk herd area (Figure 6); while Tribal hunting usually accounts for a greater percentage of the cow harvest (Figure 7). Tribal harvest has been declining in recent years, which is due in part to challenges they face accessing private timberlands. Hunter effort, reported as hunter days, has been on a slightly downward trend in the Olympics, but increased in 2018 (Figure 8). The estimates of CPUE, reported as number of elk killed per 100 days, was at a period high in 2018 (Figure 9). Total harvest in Figure 6 includes reported Tribal game harvest data which 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; 2008-2017/18). On average, Tribal hunting accounts for 36% of the total elk harvest in the Olympic elk herd area.

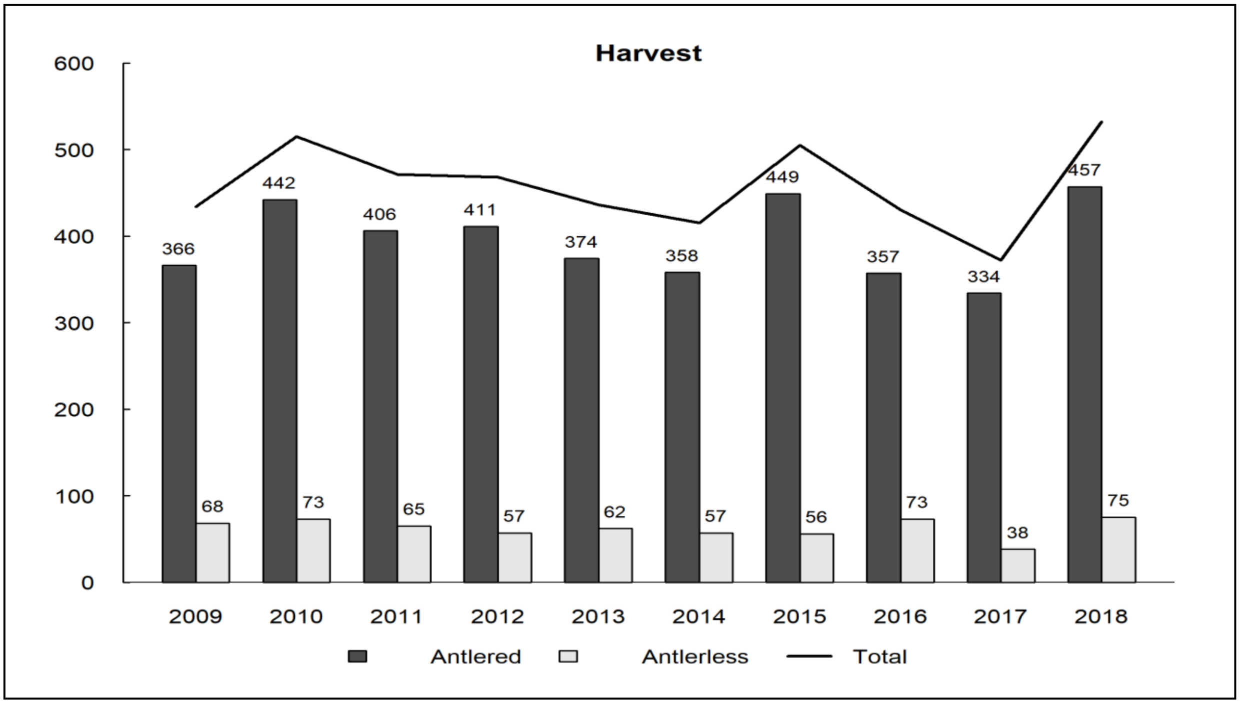

Figure 5. Estimated number of antlered and antlerless elk harvested in the Olympic elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department and during established Tribal seasons, 2009-2018. Estimates of Tribal harvest were derived from annual harvest reports compiled by the Northwest Indian Fisheries Commission. Estimates do not include elk harvested in association with damage permits (see Human Wildlife Interaction below).

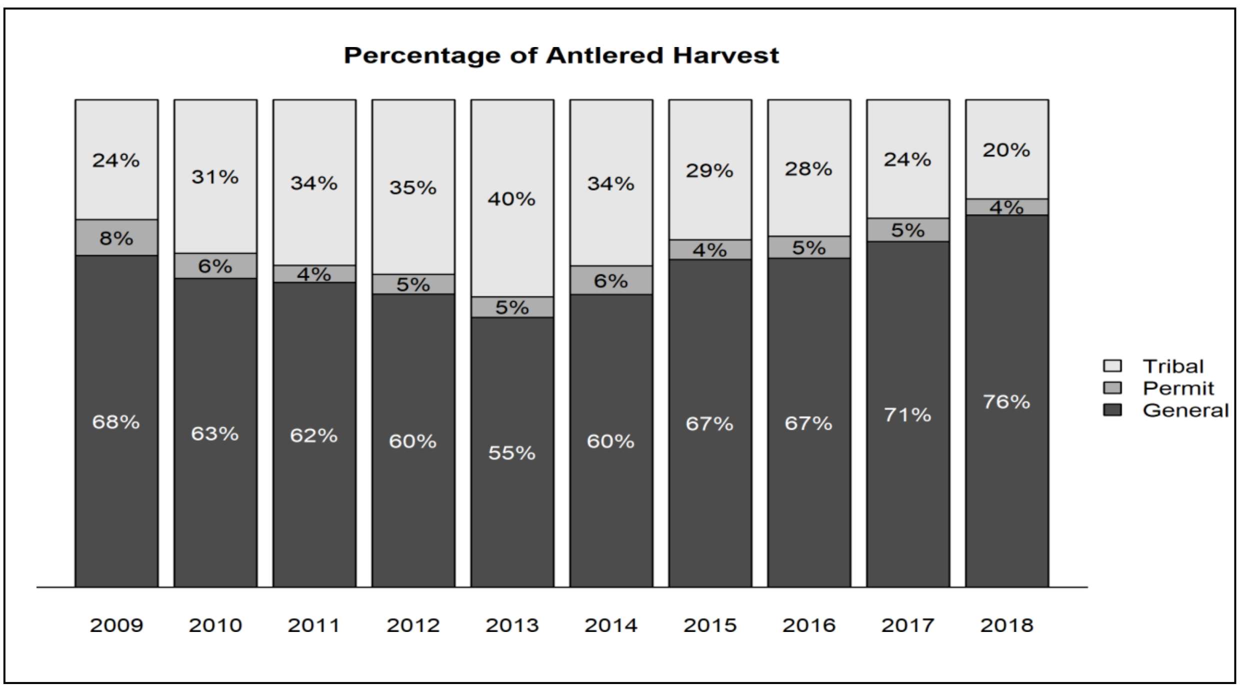

Figure 6. Estimated percentage of recreational antlered harvest in the Olympic elk herd area that occurred during general and permit seasons and the percentage of harvest that occurred during established tribal seasons, 2009-2018.

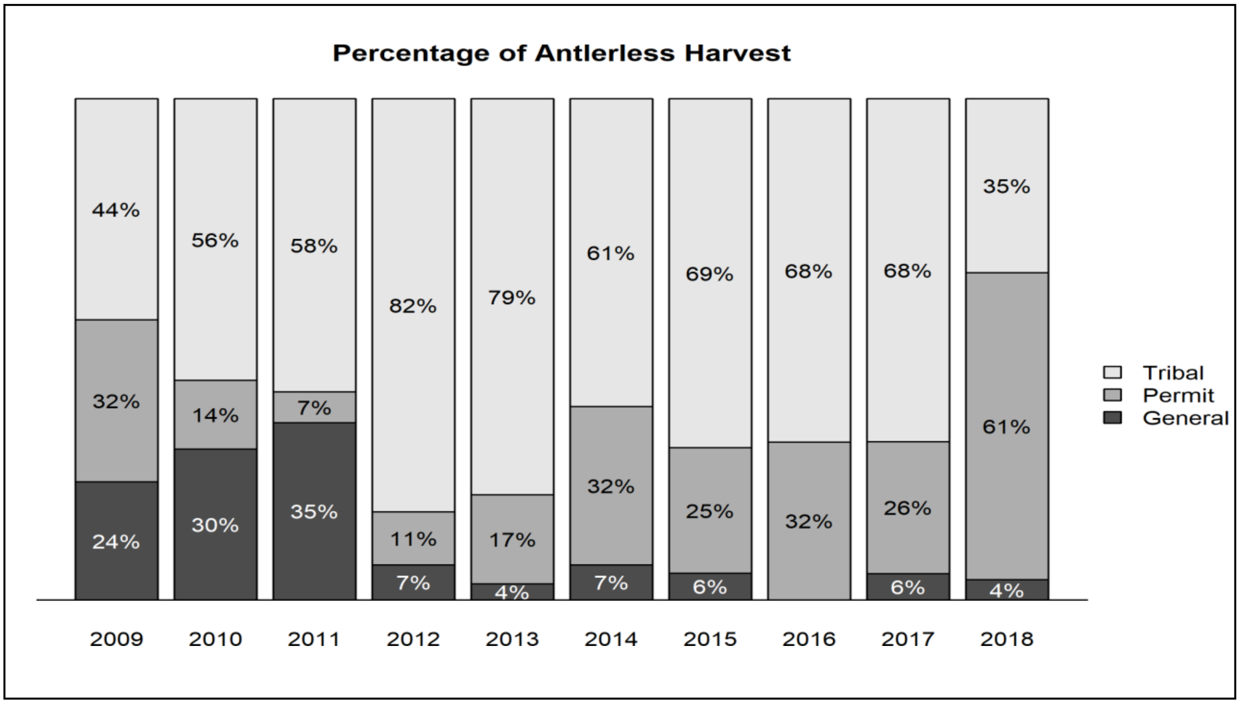

Figure 7. Estimated percentage of recreational antlerless harvest in the Olympic elk herd area that occurred during general and permit seasons and the percentage of harvest that occurred during established tribal seasons, 2009-2018.

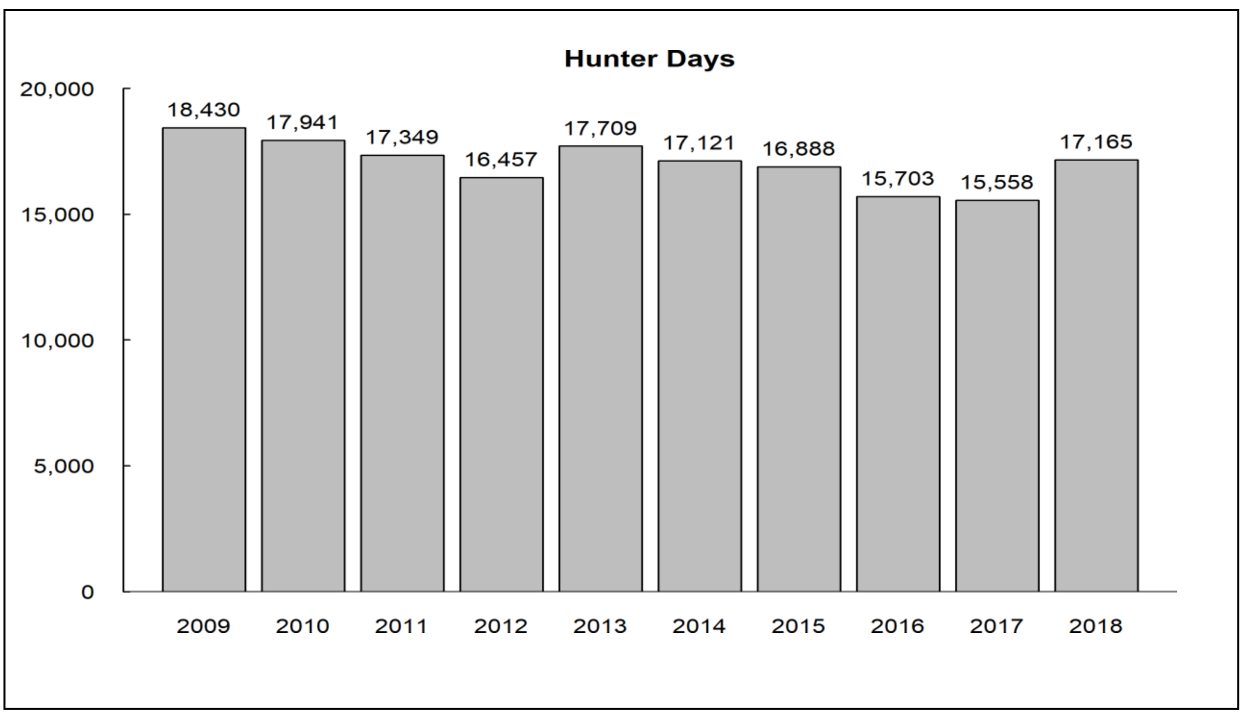

Figure 8. Estimated number of days hunters spent pursuing elk in the Olympic elk herd area during recreational seasons that provided general over-the-counter opportunities, 2009-2018.

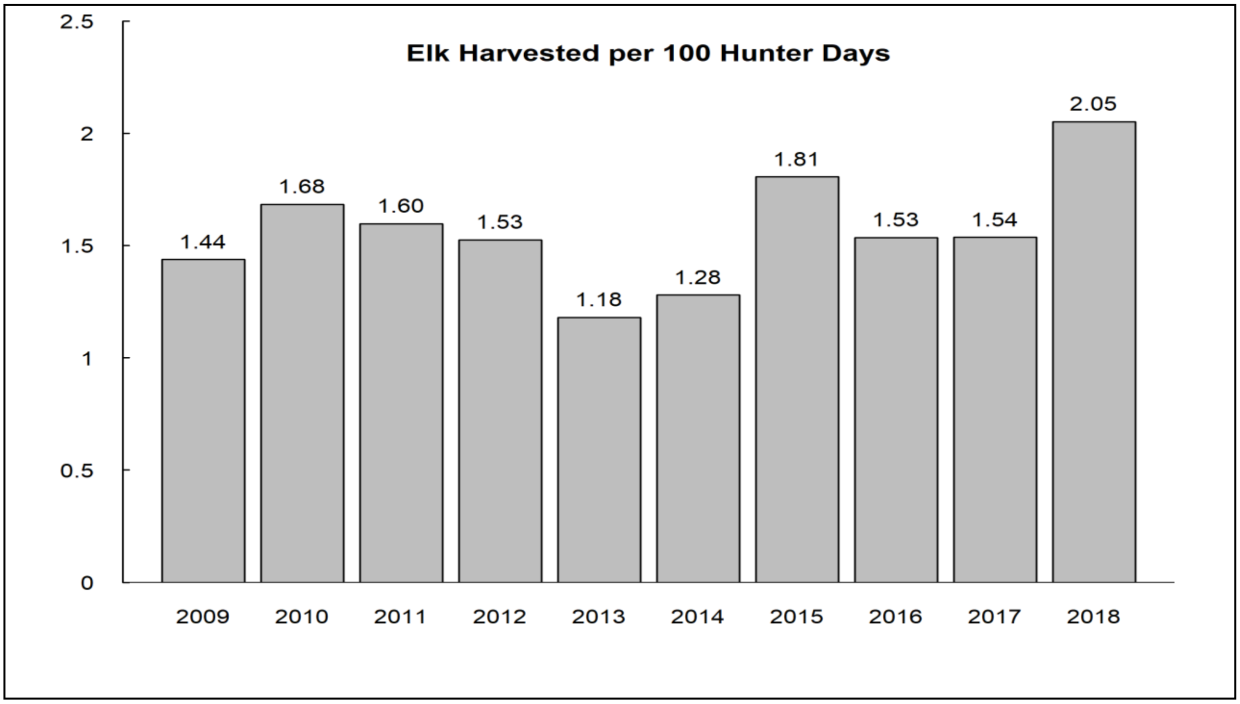

Figure 9. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the Olympic elk herd area during recreational seasons that provided general over-the-counter opportunities, 2009-2018.

Survival and Mortality

There have been no comprehensive studies to estimate the survival of elk throughout the Olympic elk herd area during a specific time period; however, the Department and several Treaty Tribes have conducted numerous projects in specific GMUs. Cow survival is generally higher than 80% (Smith et al. 1994; WDFW, unpublished data; R. McCoy, Makah Tribe, unpublished data). Bull survival has been documented to be 23% (Smith et al. 1994) and 29% (R. McCoy, Makah Tribe, unpublished data). Calf survival ranged from 27-40% in one study conducted in GMUs 601 and 602 by the Makah Tribe (R. McCoy, unpublished data).

Causes of mortality among Olympic elk include nutritional stress, predation, legal harvest, poaching, and a variety of other natural and human-related causes (vehicle collision, for example). Malnutrition and predation are the most common factors associated with the mortality of cows and calves (Smith et al. 1994; WDFW, unpublished data; R. McCoy, Makah Tribe, unpublished data). Hunter harvest is the most common cause of mortality among bulls (Smith et al. 1994; R. McCoy, Makah Tribe, unpublished data). Poaching related mortality accounted for 2.5% among bulls and cows in the Olympic herd in one study (Smith et al. 1994).

Habitat

The Olympic elk herd area encompasses a diverse array of habitat types rising in elevation from the coastal and inland marine ecosystems at sea level through a series of forested zones that change with increasing elevation and rainfall. These zones include forests dominated by Sitka spruce (*Picea sitchensis*), then western hemlock (*Tsuga heterophylla*) and Pacific silver fir (*Abies amabilis*), until reaching the subalpine forests dominated by mountain hemlock (Tsuga mertensiana) and subalpine fir (*Abies lasiocarpa*) at higher elevations (Franklin and Dyrness

1973). Douglas fir (*Pseudotsuga menziesii*) and western red cedar (*Thuja plicata*) are also common in the Sitka spruce and western hemlock zones, while areas in the subalpine zones often have open parklands and subalpine meadows (Franklin and Dyrness 1973, Henderson et al. 1989).

The western hemlock zone is the most extensive within the Olympic elk herd, and along with areas in the Sitka spruce zone, has probably undergone the most significant alteration through timber harvest and replanting, often with Douglas fir (WDFW 2004). Elk demographics (survival and productivity, for example) are strongly influenced by forest management practices that have created a patchwork of stand types and ages, each with varying degrees of value for elk. Early seral stands, riparian zones, and mature to old growth forests tend be of most value to elk, while those stands 20-30 years after clearcutting have the least value (Lopez-Perez, 2004). Early seral stands are most common on private and state lands currently managed for timber production. Following a fairly robust timber harvest in the 1970s and 1980s, recent management of USFS lands within the Olympic elk herd area tend to promote the persistence of mid-to-late seral forests, which are of less value to elk. However, the USFS is conducting habitat enhancement activities, including thinning and forage seeding in some areas for elk.

WDFW actively manages 2,034 acres of land in the Olympic elk herd area specifically to provide habitat for elk either as mitigation for lost habitat due to dam construction (Wynoochee Mitigation Unit, 1,030 acres of habitat, including pastures planted to provide elk winter forage) or as a means to reduce agricultural crop damage on adjacent private land (Olympic Unit, 963 acres; Anderson Homestead, 41 acres). Private pasture lands, planted for other agricultural purposes, can also be an important component of elk habitat in many GMUs, but in many cases, agricultural landowners do not welcome elk on their property.

The effect of weather on elk is mostly related to those conditions that influence the quality and availability of forage. Unusually dry and hot conditions during summer and early fall will reduce the availability of forage during a critical time for elk, as they attempt to recover lost energy stores from the previous winter, prepare for the next winter, and for some, raise a calf. The Olympic elk herd area experienced slightly above normal temperatures and below normal precipitation during the summer of 2017.

In winter, a period when forage conditions naturally decline, snow accumulation, if substantial and persistent can reduce access to what forage is available and reduce or hinder elk movement. These snow effects usually occur when accumulations are persistent and approach 20 inches or more (Poole and Mowat, 2005). Fortunately, weather conditions over much of the Olympic elk herd area tend to be mild and temperate (Washington Climate Center Data) and snow accumulations are most likely to have a more pronounced effect on elk at higher elevations in the Olympic National Park and Olympic Wilderness Areas of USFS lands. The heavy, wet, snow typical of the Olympic Peninsula is subject to repeated thawing and freezing, which can create a thick crust of snow and ice reducing access to forage.

Human-Wildlife Interaction

Elk conflict in the Olympic elk herd area generally falls into two categories: public safety and property damage. Public safety concerns occur where elk and urban development overlap and where elk routinely cross roadways or highways. Occasionally, both damage and public safety concerns overlap. Two of the most notable areas with overlapping concern involves elk near the towns of Sequim and Forks. Elk damage usually occurs on private agricultural lands and pastures and can create significant costs for the landowner and WDFW. Private pastureland in the Wynoochee, Satsop, and Skokomish River valleys receive chronic elk damage.

The Department employs Wildlife Conflict Specialists to work directly with landowners and communities to address human-elk conflicts using lethal and non-lethal activities; often through formal agreements termed Damage Prevention Cooperative Agreements (DPCAs). The intent of these activities is to reduce damage, increase landowner tolerance of elk, or reduce risk to human safety by reducing the number of elk and/or the amount of time elk spend on these lands. Non-lethal activities involve hazing and fencing but may also include the deployment of traffic signs that warn drivers traveling through areas where elk routinely crossroads. Lethal removals are conducted either through permits issued to landowners, special permit hunts, or during general season hunts within a designated Elk Area. Wildlife Conflict Specialists may also remove elk under an agency kill authority permit.

In 2018/19, there were 37 active DPCAs in the Olympic elk herd area, 118 permits were issued to remove elk, and 48 elk were harvested (Table 1). Additionally, nine Master Hunters removed nine elk from the Olympic herd (Table 1).

Table 1. The number of Damage Prevention Cooperative Agreements (DPCAs), permits issued and elk removed, and the number of Master Hunters deployed and their harvest in 2018/19 for Game Management Units (GMU) in the Olympic elk herd area.

GMU	DPCAs	Permits Issued	Elk Removed	Master Hunter Deployed	Master Hunter Harvest
607	4	13	3		
612	1	6	2		
615	1	2	2		
624	4	8	5		
636	5	13	8		
642	4	3	2	3	3
648	11	42	12	2	2
651	7	31	14	4	4
Total	37	118	48	9	9

Management Concerns

The Olympic Elk Herd Plan (WDFW 2004), which provides management objectives and guidance for monitoring is currently being updated. A formalized monitoring strategy is under development, as the herd plan is updated. Monitoring during this interim period has been limited to specific GMUs or portions thereof. WDFW has relied primarily on hunting harvest data as the basis for management decisions and the work of the Olympic Peninsula Treaty Tribes for herd demographics and other information.

Management Conclusions

Elk harvest in the Olympic elk herd area declined during 2010 to 2014, increased in 2015, but again dropped below the 10-year average in 2016 and 2017; however, elk harvest in 2018 was at a period high. The increase in harvest recorded in 2015 occurred during the general season and was in part due to a regulation change adding general season muzzleloader hunting opportunities in several GMUs; general archery season elk harvest was also up in 2015. The increase in elk harvest in 2018 appears to be related to an increase in elk hunters with better than average success.

Literature Cited

Brodie, J., H. Johnson, M. Mitchell, P. Zager, K. Proffitt, M. Hebblewhite, M. Kauffman, B. Johnson, J. Bissonette, C. Bishop, J. Gude, J. Herbert, K. Hersey, M. Hurley, P. Lukacs, S. McCorquodale, E. McIntire, J. Nowak, H. Sawyer, D. Smith, and P. J. White. 2013. Relative influence of human harvest, carnivores, and weather on adult female elk survival across western North America. Journal of Applied Ecology 50:295–305.

Caughley, G. 1974. Interpretation of age ratios. Journal of Wildlife Management 38:557–562. Franklin, J. F. and C. T. Dyrness. 1973. Natural vegetation of Oregon and Washington. U.S.D.A. Forest Service General Technical Report PNW-8. 417 pp. Pacific Northwest Forrest and Range Experiment Station, Portland, OR.

Henderson, J.A., D.H. Peter, R. D. Lesher, and D. C. Shaw. 1989. Forested plant associations of the Olympic National Forest. USDA Forest Service, Pacific Northwest Region. R6 Ecol. Technical Paper 001-88.

Lopez-Perez, E. 2006. Natural selenium and planted forages: effects on mule deer and elk in Washington. Dissertation, Washington State University, Pullman, USA. 112pp.

Poole, K. G. and G. Mowat. 2005. Winter habitat relationships of deer and elk in the temperate interior mountains of British Columbia. Wildlife Society Bulletin 33(4): 1288-1302.

Raithel, J. D., M. J. Kauffman, and D. H. Pletscher. 2007. Impact of spatial and temporal variation in calf survival on the growth of elk populations. Journal of Wildlife Management 71:795– 803.

Skalski, J. R., K. E. Ryding, and J. J. Millspaugh. 2005. Wildlife Demography: Analysis of sex, age, and count data. Elsevier Academic Press, Burlington, Massachusetts, USA.

Smith J. L., W. A. Michaelis, K. Sloan, J. L. Musser and D. J. Pierce. 1994. An analysis of elk poaching losses and other mortality sources in Washington using biotelemetry. Washington Department of Fish and Wildlife, Federal Aid in Wildlife Restoration Project Report. 79 pp.

Washington Department of Fish and Wildlife. 2004. Olympic Elk Herd Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA.

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

Selkirk Elk Herd

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Introduction

The Selkirk elk herd is located in northeast Washington and includes the Pend Oreille and Spokane sub-herds. The Pend Oreille sub-herd consists of 9 GMUs, including 101 (Sherman), 105 (Kelly Hill), 108 (Douglas), 111 (Aladdin), 113 (Selkirk), 117 (49 Degrees North), 121 (Huckleberry), 124 (Mount Spokane), and 204 (Okanogan East) (Figure 1). The Spokane sub-herd consists of 6 GMUs, including GMUs 127 (Mica Peak), 130 (Cheney), 133 (Roosevelt), 136 (Harrington), 139 (Steptoe), and 142 (Almota) (Figure 1).

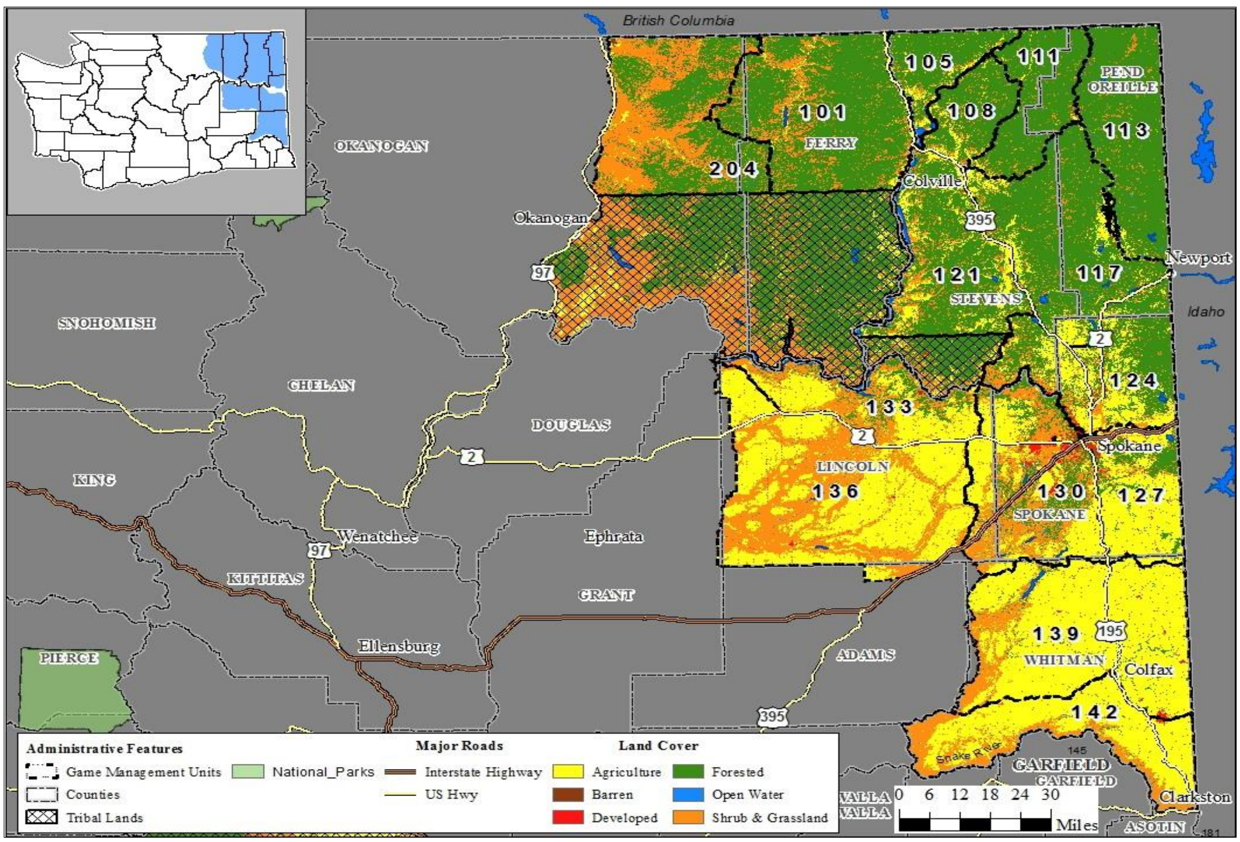

Figure 1. Dominant land use cover types within the 15 game management units that comprise the Selkirk elk herd area.

Management Guidelines and Objectives

The Department's objective is to increase elk abundance in the Pend Oreille sub-herd area to 1,500-2,500 elk and to maintain 1,000-1,500 elk in the Spokane sub-herd area (WDFW 2014a). Additional objectives include maintaining populations with a pre-hunt bull:cow ratio of 15-35 bulls:100 cows or post-hunt bull:cow ratio of 12-20 bulls:100 cows (WDFW 2014a) and maintaining an annual survival rate of 0.50 for bulls when bull mortality is monitored (WDFW 2014b).

Population Surveys

Habitat and terrain within the Pend Oreille sub-herd area present a sampling environment that is not conducive for typical aerial composition surveys because the dense and largely unbroken forests impede the ability of observers to detect elk. Consequently, the Department does not currently conduct surveys to monitor the Pend Oreille sub-herd.

The Department collaborates with the U.S. Fish and Wildlife Service (USFWS) to conduct pre-hunt aerial composition surveys on the Turnbull National Wildlife Refuge (TNWR), located in the Spokane sub-herd area. However, these surveys only include a small portion of the Spokane sub-herd and are not likely to be representative of the entire sub-herd. The number of elk observed during these surveys since 2006 has ranged from 154–460 elk and varies annually (Figure 2). The decline observed in this population since 2010 is the result of a concerted effort by WDFW and TNWR, through antlerless hunts on TNWR, to reduce this local population due to elk suppression of aspen regeneration on the refuge. However, the population reduction is not only a result of direct mortality from hunting on the refuge, but also likely due to elk leaving the TNWR survey area for other nearby areas with more hunting pressure. Estimated calf:cow ratios have been relatively stable (Figure 4), while estimated bull:cow ratios have shown more variability but have been consistently within or above the management objective of 15-35 bulls:100 cows (Figure 3).

Hunting Seasons and Recreational Harvest

Most general season harvest opportunities in the Pend-Oreille sub-herd area are for any bull. Most opportunities to harvest antlerless elk are through limited, special permit opportunities. However, opportunities to harvest antlerless elk do occur throughout the sub-herd area during general archery seasons and for all weapon types in GMU 124 where the Department's objective is to maintain elk numbers within landowner tolerance. Estimates of harvest during general seasons and total harvest in the Pend Oreille sub-herd have averaged 286 and 314 elk, respectively, 2009-2018, and have been stable 2010-2017 (Figure 5). Nearly all bull harvest (Figure 6) and the majority of antlerless harvest (Figure 7) occurs during general season. Hunter effort and CPUE have also been stable for that sub-herd since 2009 (Figures 8-9).

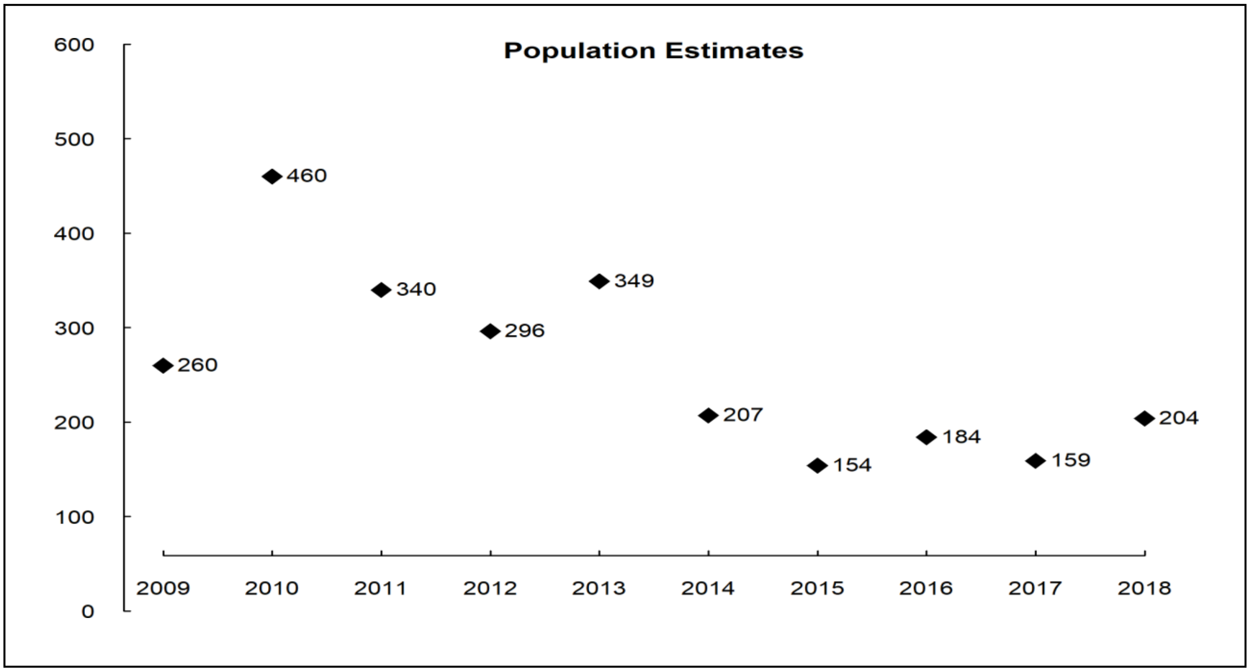

Figure 2. Number of elk observed during aerial composition surveys in autumn on the Turnbull National Wildlife Refuge, autumn 2009–2018.

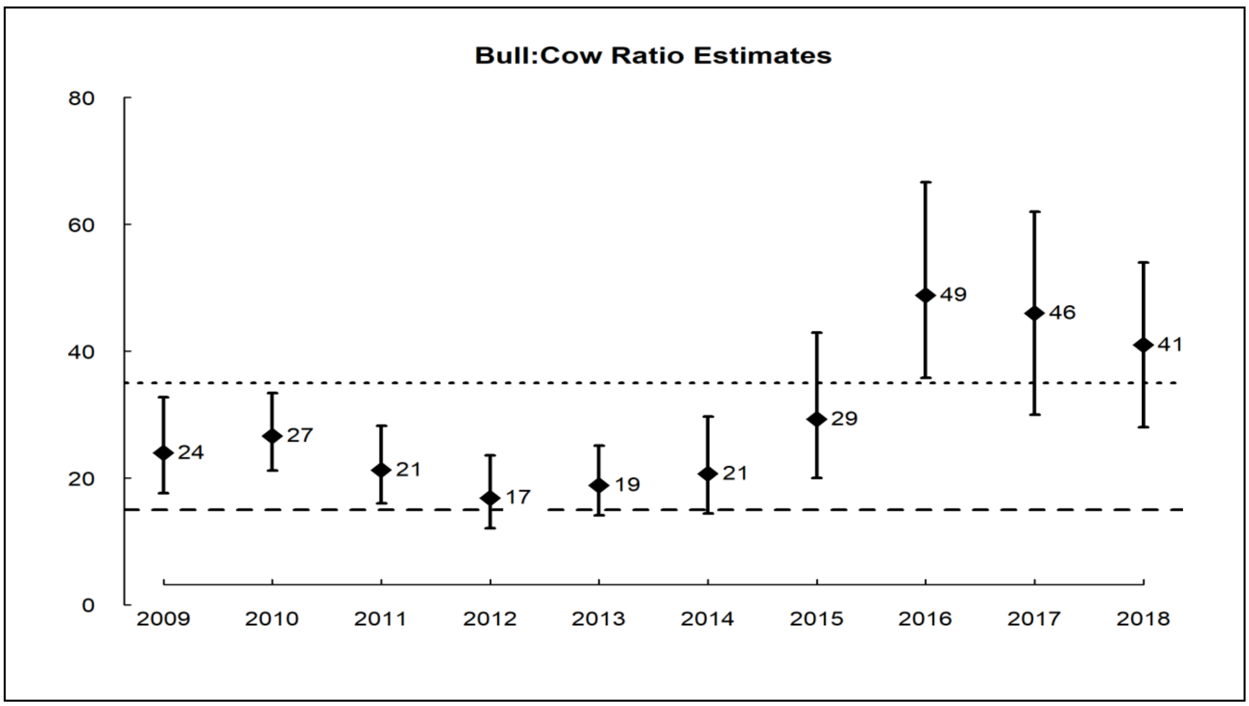

Figure 3. Estimates and associated 95% confidence intervals of pre-hunt bull:cow ratios on the Turnbull National Wildlife Refuge, autumn 2009–2018. The dashed lines represent the objective range of 15-35 bulls:100 cows.

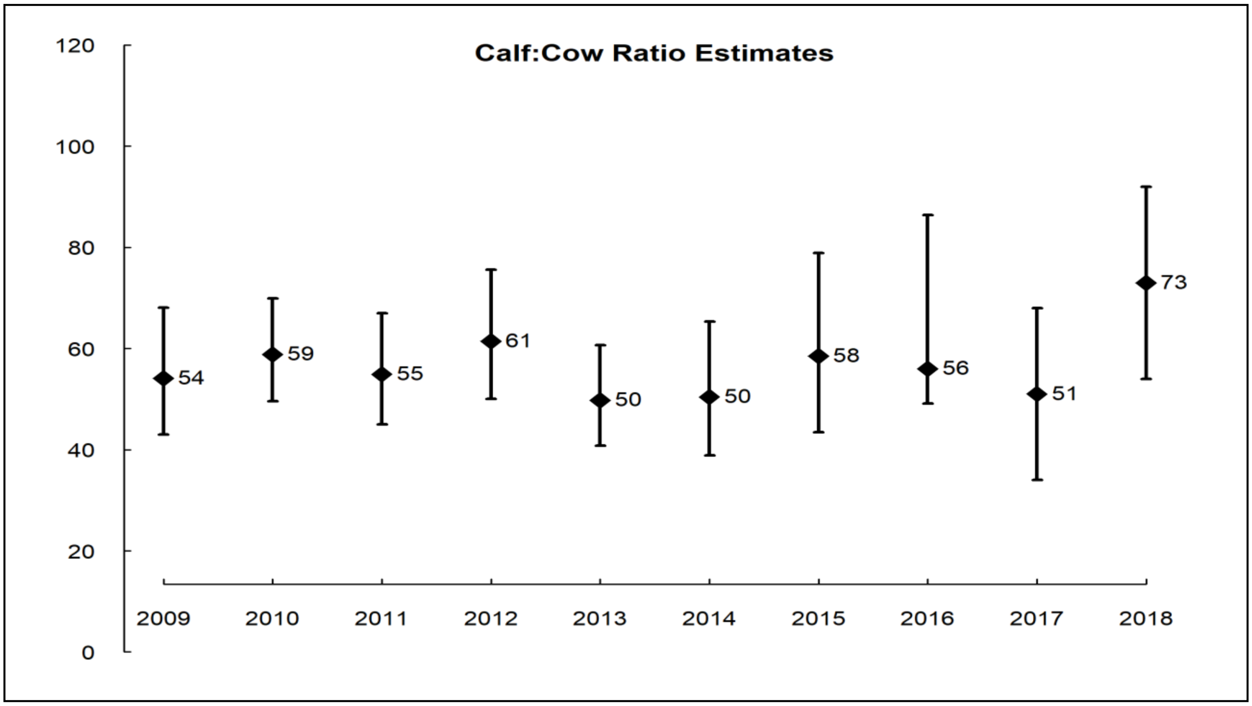

Figure 4. Estimates and associated 95% confidence intervals of pre-hunt calf:cow ratios on the Turnbull National Wildlife Refuge, autumn 2009–2018.

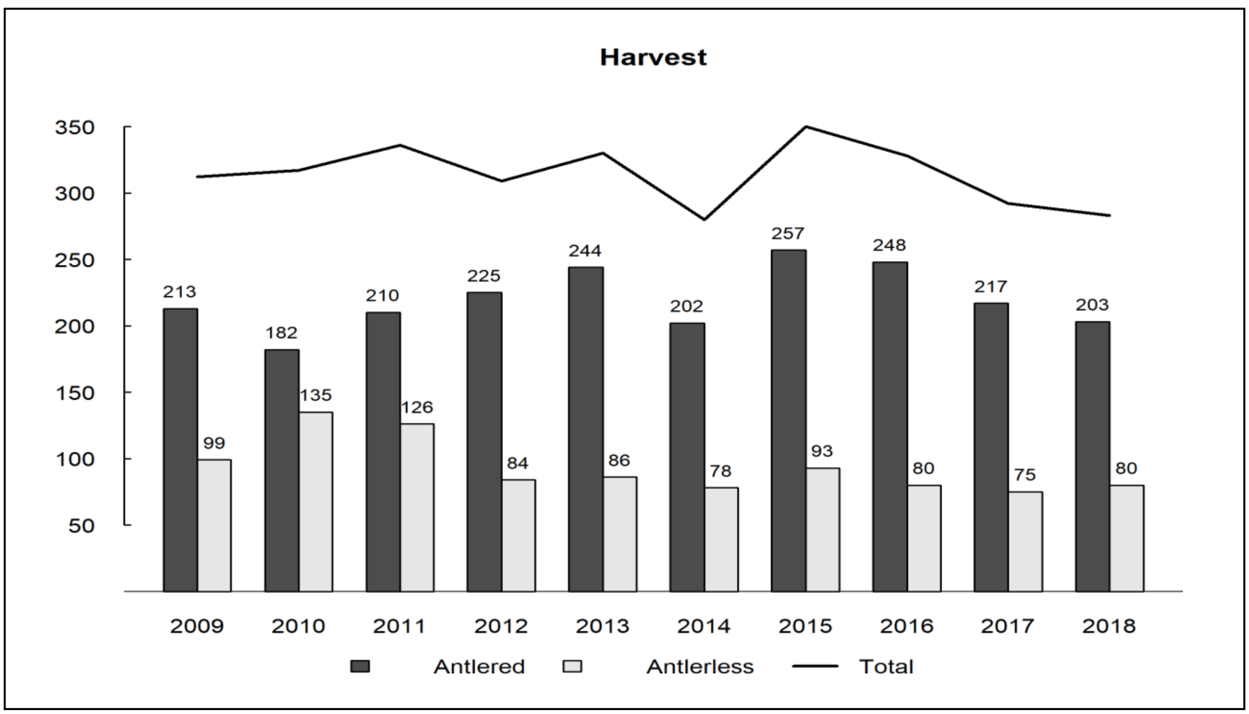

Figure 5. Estimated number of antlered and antlerless elk harvested in the Pend-Oreille sub- herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department, 2009–2018. Estimates do not include elk harvested in association with damage permits (see Human Wildlife Interaction below). Estimates also do not include harvest that occurred during established Tribal seasons because that data is currently not available.

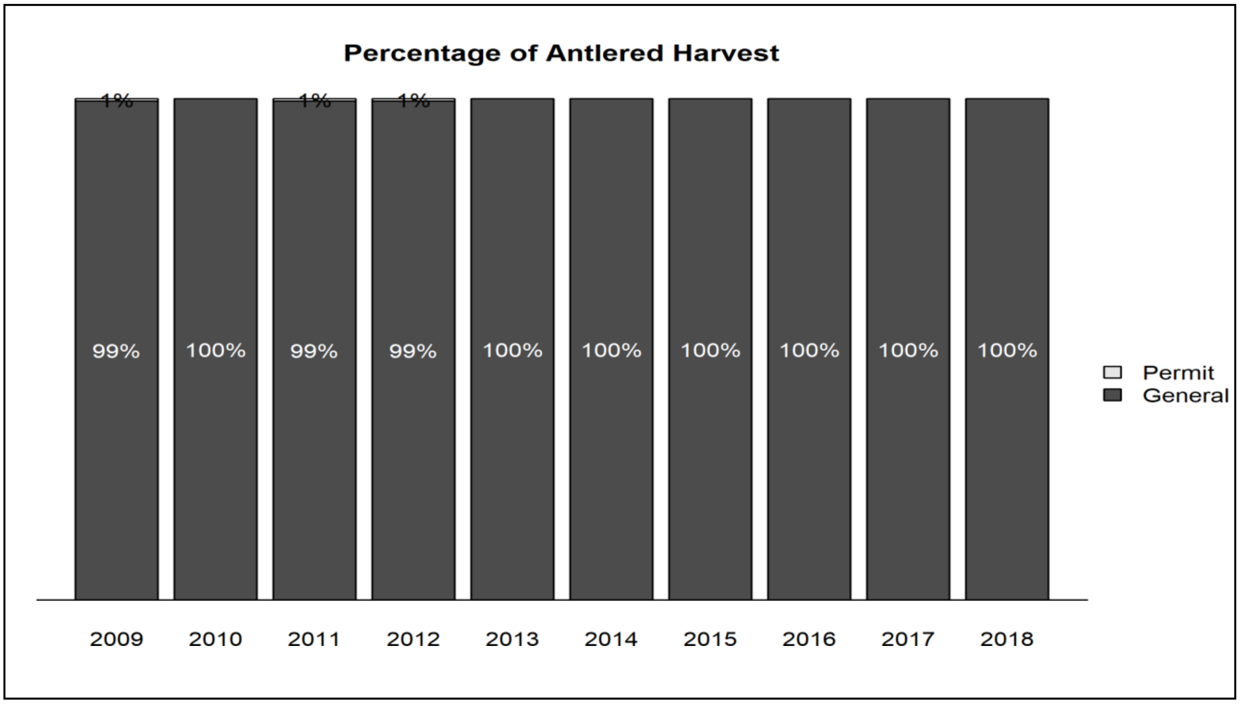

Figure 6. Estimated percentage of recreational antlered harvest in the Pend-Oreille sub- herd area that occurred during general and permit seasons, 2009–2018.

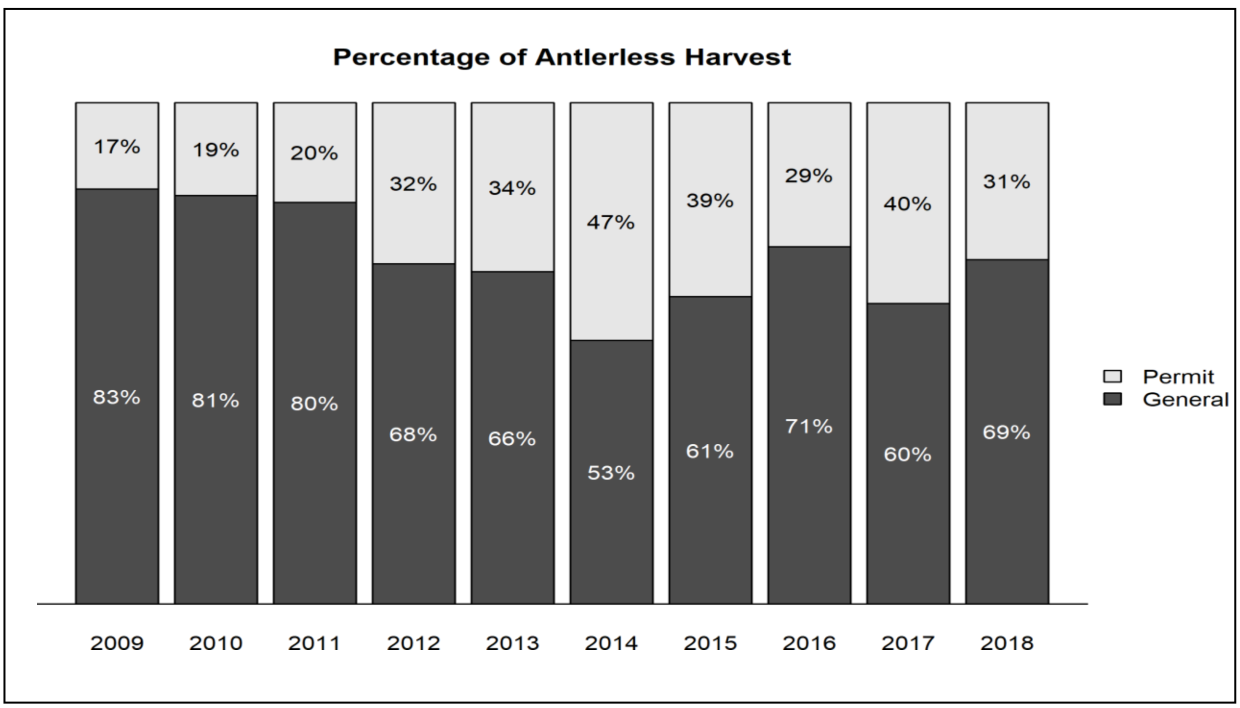

Figure 7. Estimated percentage of recreational antlerless harvest in the Pend-Oreille sub-herd area that occurred during general and permit seasons, 2009–2018.

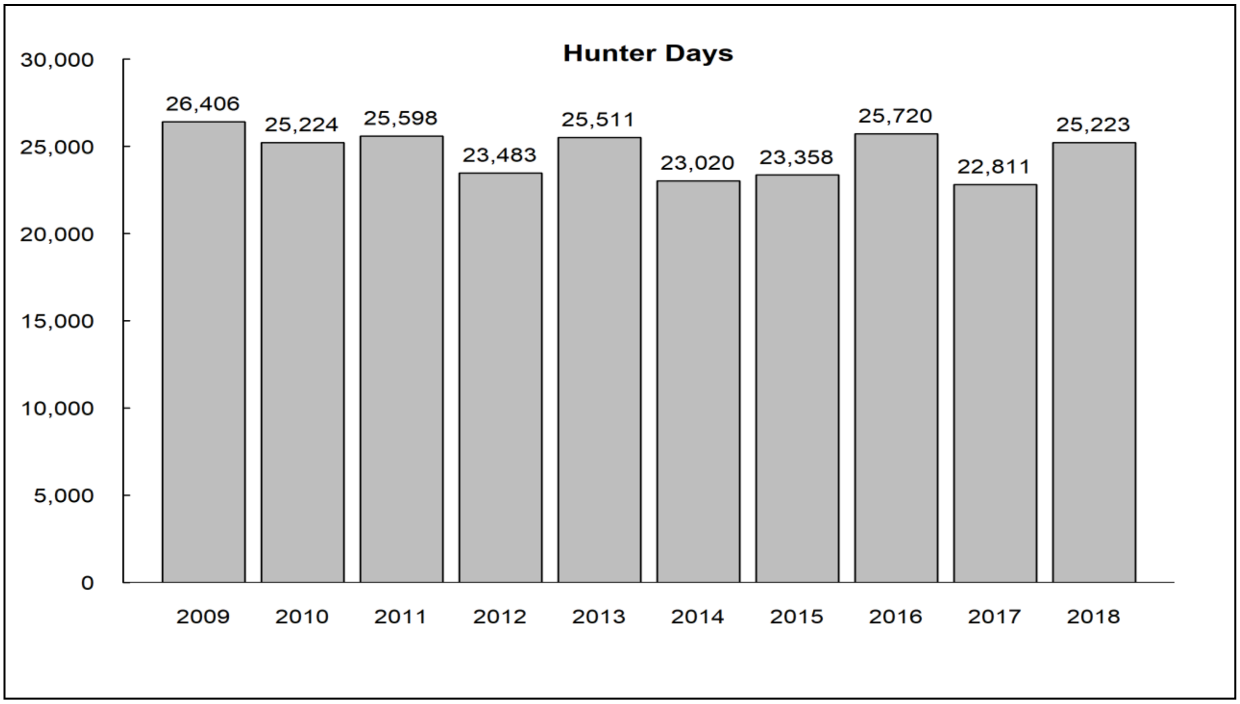

Figure 8. Estimated number of days hunters spent pursuing elk in the Pend-Oreille sub- herd area during recreational seasons that provided general over-the-counter opportunities, 2009– 2018.

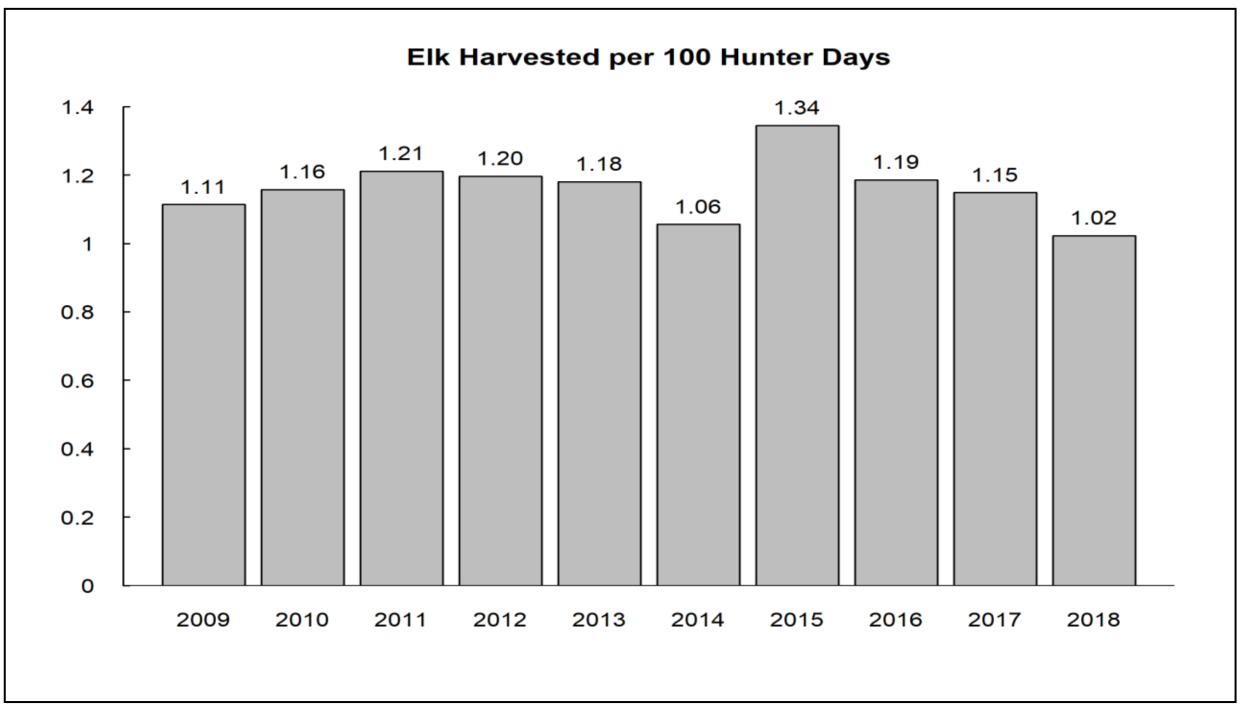

Figure 9. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the Pend-Oreille sub-herd area during recreational seasons that provided general over-the- counter opportunities, 2009–2018.

The Department allows the harvest of any elk during all general seasons in the Spokane sub-herd area and collaborates with the USFWS to implement special permit harvest opportunities on TNWR. Estimates of harvest during general seasons and total harvest in the Spokane sub-herd area averaged 235 and 251 elk, respectively for 2009-2018 (Figure 10). The majority of elk harvested in the Spokane sub-herd are done so during general seasons (Figures 11 & 12). Harvest estimates (Figure 10), hunter effort (Figure 13), and CPUE (Figure 14) vary annually in this sub- herd. Likely much of this variation is a reflection of the access to private lands and the patchy distribution of elk in this area, rather than true variation in the elk population. The increase in general harvest after 2009 is likely due to the implementation of the TNWR permit hunts pushing animals off the refuge during the general season.

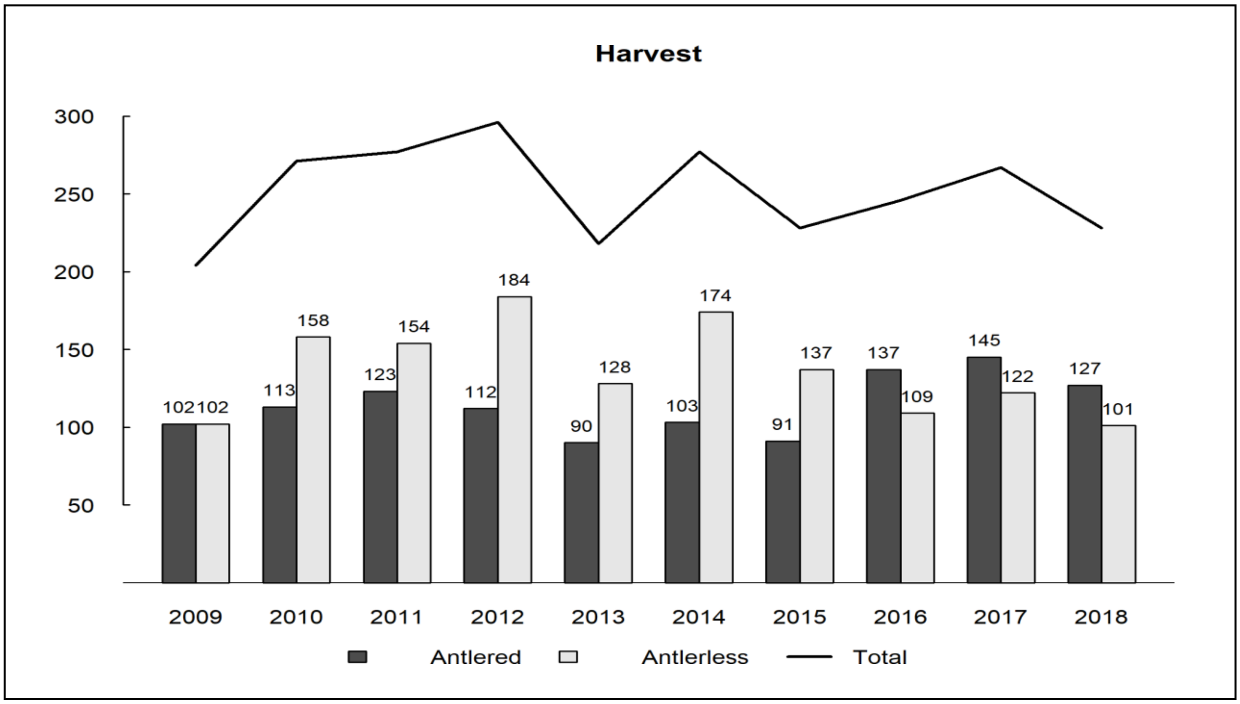

Figure 10. Estimated number of antlered and antlerless elk harvested in the Spokane sub-herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department, 2009–2018. Estimates do not include elk harvested in association with damage permits (see Human Wildlife Interaction below). Estimates also do not include harvest that occurred during established Tribal seasons because that data is currently not available.

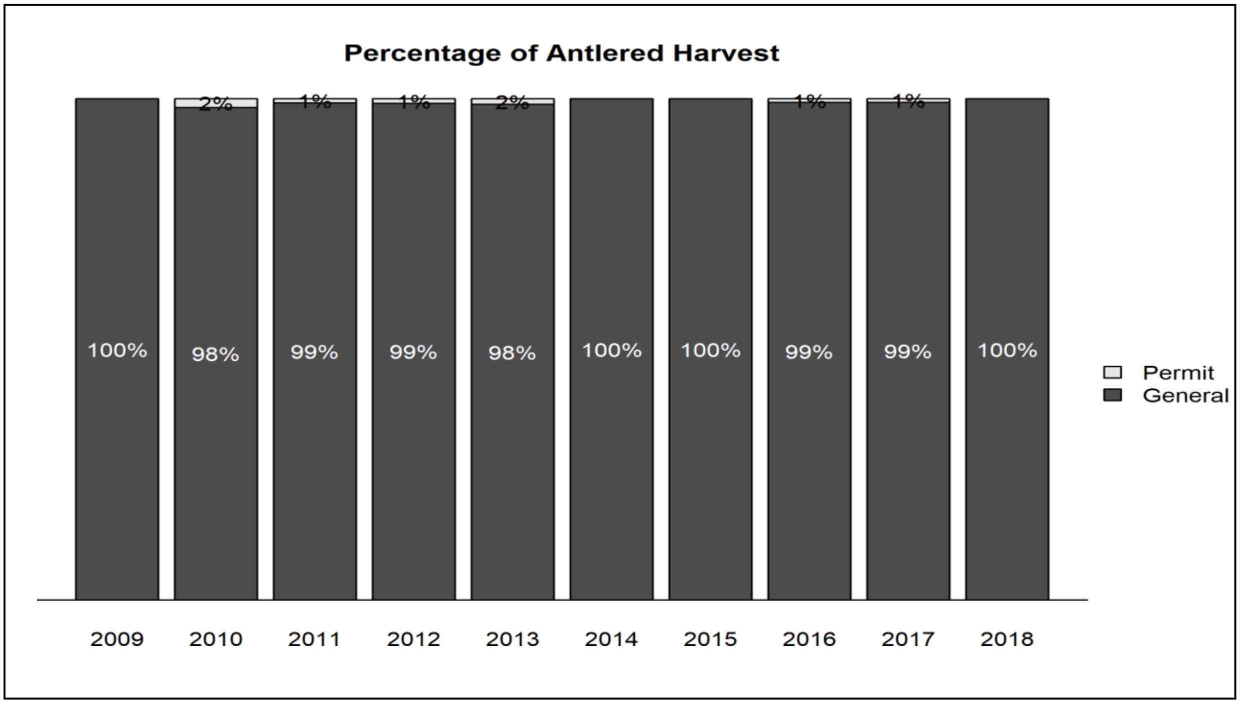

Figure 11. Estimated percentage of recreational antlered harvest in the Spokane sub- herd area that occurred during general and permit seasons, 2009–2018.

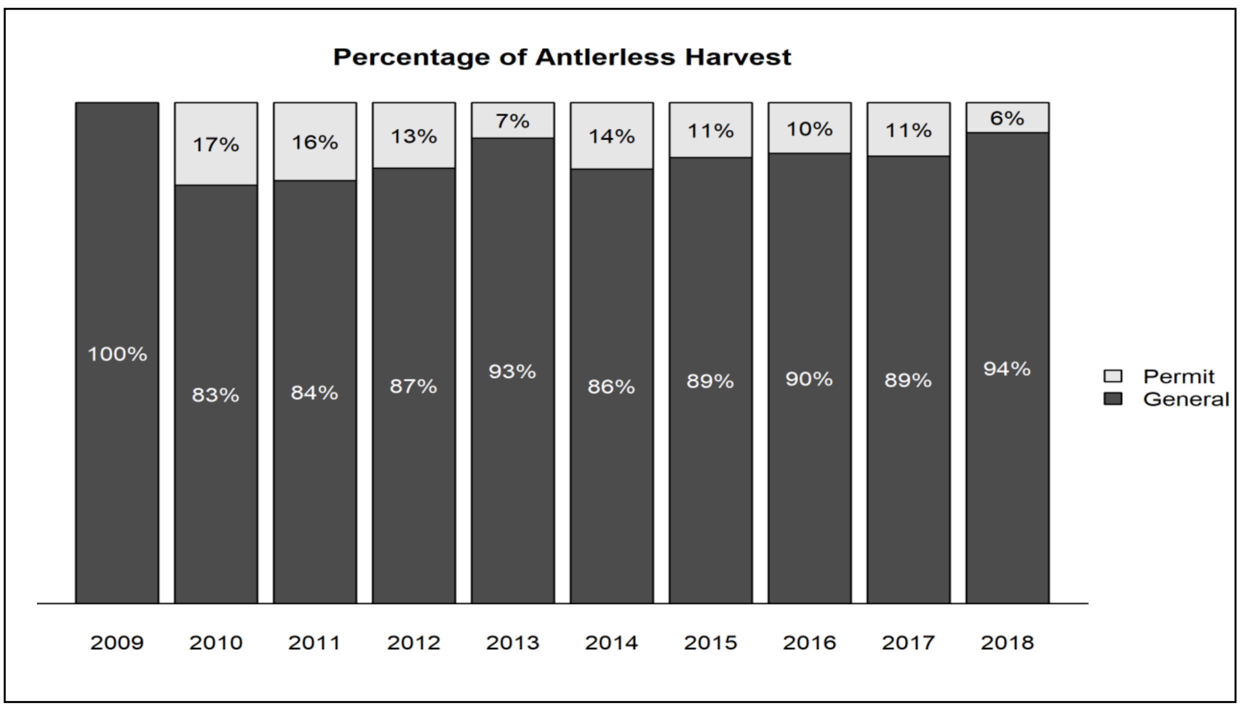

Figure 12. Estimated percentage of recreational antlerless harvest in the Spokane sub-herd area that occurred during general and permit seasons, 2009–2018.

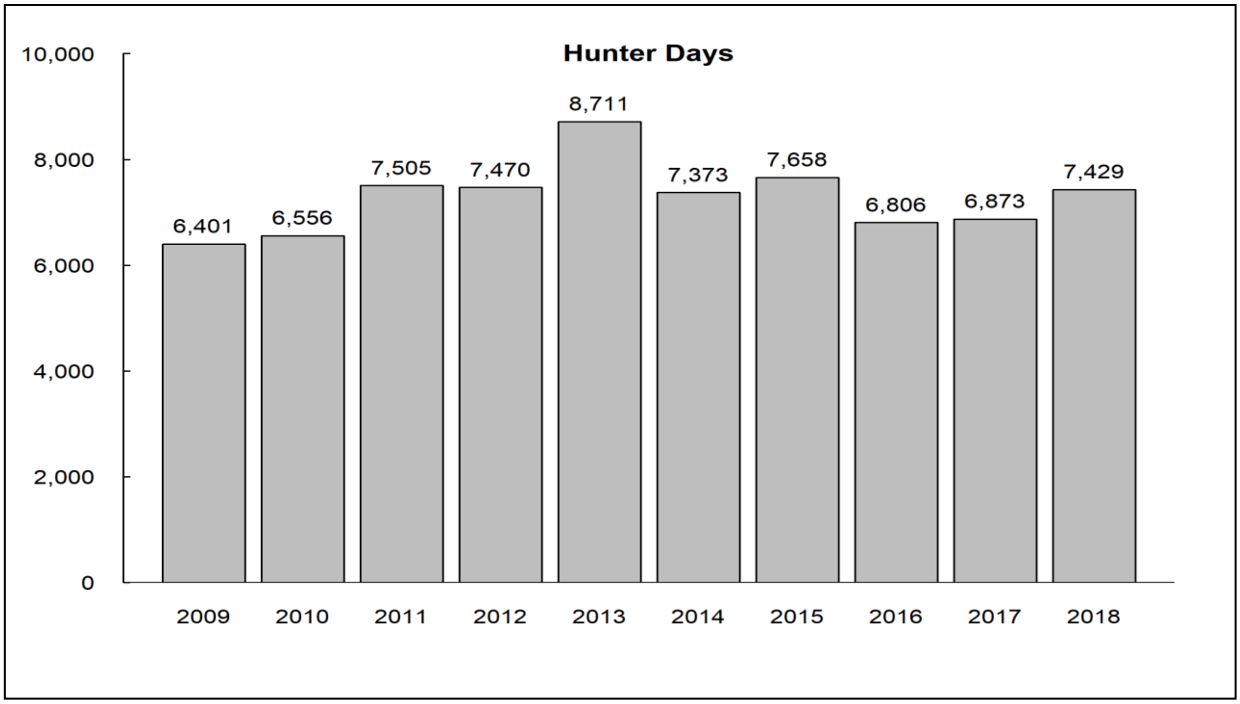

Figure 13. Estimated number of days hunters spent pursuing elk in the Spokane sub-herd area during recreational seasons that provided general over-the-counter opportunities, 2009–2018.

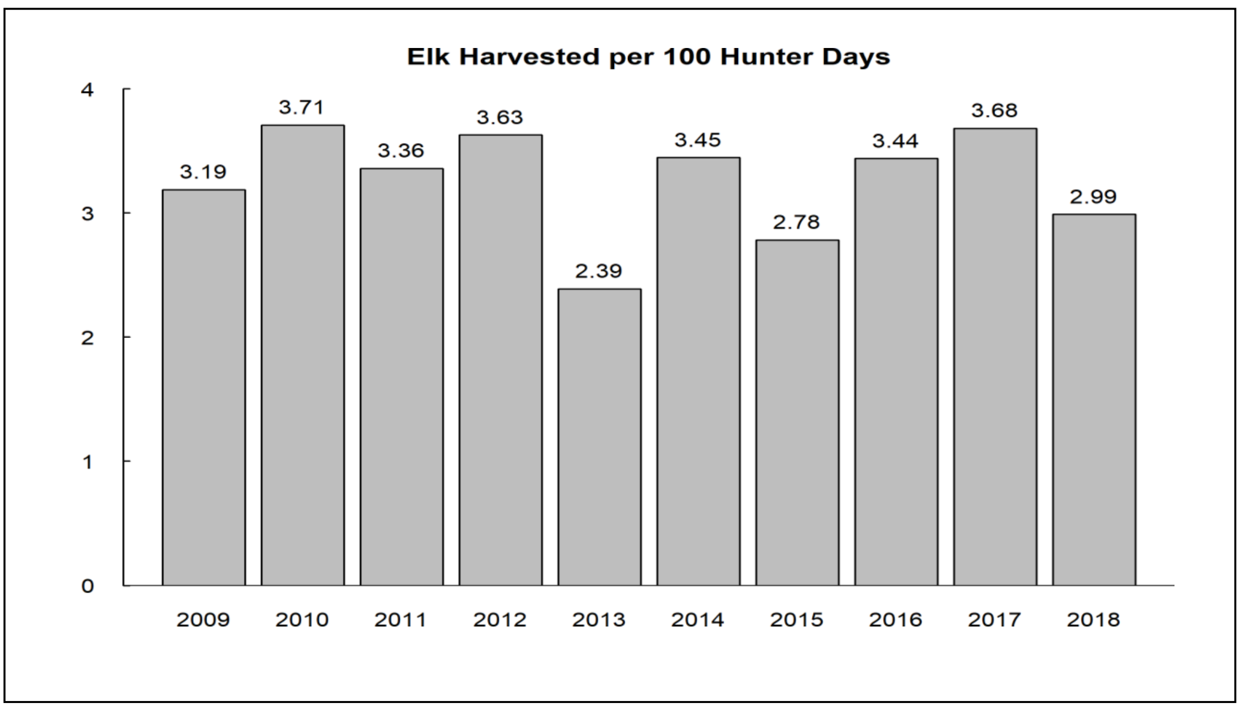

Figure 14. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the Spokane sub-herd area during recreational seasons that provided general over-the-counter opportunities, 2009–2018.

Survival and Mortality

Common predators that occur throughout the Pend Oreille sub-herd area include black bears, cougars, and gray wolves. The Department documented the first wolf pack in the Pend Oreille sub-herd area in 2009. As of December 31, 2018, the Department documented 18 wolf packs whose range currently occurs wholly or partially within the Pend Oreille sub-herd area (WDFW et al. 2019).

Black bears and cougars also occur throughout the Spokane sub-herd area. Both habitat conditions and hunter harvest suggest that bear and cougar numbers are likely higher north of the Spokane River in the Pend Oreille sub-herd area than in the Spokane sub-herd area (WDFW 2014a). Most cougar and black bear populations are managed to maintain a stable population. At the time of this writing, there were no documented gray wolf packs in the Spokane sub-herd area (WDFW et al. 2019).

Although the Department has never documented any increased mortality events, severe winter events do occur within the Pend Oreille and Spokane sub-herd areas and likely have the potential to reduce the overwinter survival of elk. In addition, extreme drought conditions that can persist through summer and fall are becoming more frequent, especially in the Spokane sub-herd, which have the potential to reduce the availability of high-quality forages that elk rely on to accrue adequate fat stores for winter. This can affect adult survival directly but is more likely to have a population impact via reduced calf recruitment.

Obtaining elk survival estimates and causes of mortality for the Pend Oreille sub-herd is one goal of the predator-prey project (see research section), but because the project is only in year three of five, there are no estimates currently available. There have been no comprehensive efforts to monitor the survival of elk in the Spokane sub-herd area.

Habitat

Timber harvest is common on state forestlands and even more intensive on private lands. Timber harvest is limited on federal forests. Logging potentially benefits the Pend Oreille sub-herd by increasing the amount of early seral habitats. In addition, the Colville National Forest, with grant money from the Rocky Mountain Elk Foundation (RMEF), has implemented habitat enhancement projects on approximately 58,000 acres to benefit elk. 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 RMEF also funded a prescribed burn on 390 acres of elk habitat on the WDFW Chesaw Wildlife Area within the Pend Oreille sub-herd area. Over 350,000 acres within the Pend Oreille sub-herd area were burned by wildfires in the summer of 2015 and approximately 10,601 more acres burned in 2017. These burns will likely benefit elk in the long term, but some areas burned completely and with high intensity, thus it may be years before any benefits to elk are realized.

Conversion of native Palouse Prairie and shrub-steppe habitat in the Spokane sub-herd area to agricultural lands has and continues to reduce the amount of native elk habitat. However, irrigated alfalfa, hay fields, and legume crops can supply critical forage for elk during dry summers, when rancher’s haystacks are common targets for elk during harder winters. In addition, the expansion of urban populations associated with the main Spokane metropolitan area continues to result in habitat degradation or loss in GMUs 127 and 130. Consequently, it is likely that social tolerance within agricultural and suburban areas will limit the growth and expansion of the Spokane sub- herd.

Human-Wildlife Interaction

Most elk conflict is restricted to the lower-elevation agriculture lands in the Pend Oreille sub-herd. In 2018, there were approximately 7 damage prevention permits and 24 kill permits issued to landowners experiencing agricultural damage within GMUs 101, 108, 111, 113, 117, 121, and 204 with the bulk of the permits issued in GMUs 117, 121, and 204. All damage and kill permits issued were for antlerless elk only. Hunting regulations for GMU 204 were modified in 2016 to allow Early Archery while Late Muzzleloader season was switched to Early Muzzleloader to match the rest of the sub-herd area and to have hunting seasons during the time of year when most damage occurs.

Complaints of agricultural damage caused by elk in GMUs 124-142 have increased over the last several years; much of the damage has been associated with land that has been converted to legume crops (e.g., garbanzo beans, peas, and lentils). WDFW Conflict Specialists work with landowners to address current damage and develop plans to avoid future damage. Hunters are one tool used to help address damage issues. A total of 35 damage permits and 15 kill permits were issued to private landowners who were enrolled in the Damage Prevention Cooperative Agreement (DPCA) Program for elk in GMUs 124-142 in 2018. The reported harvest on those permits was 7 for damage permits and 1 for kill permits. Four Master Hunter Damage Permits were also utilized to address damage outside of the general hunting season for landowners who were not enrolled in the DPCA Program. Harassment is another common tool used to reduce damage, elk are hazed by staff, Master Hunters, and local sportsman's groups. Additionally, WDFW loans landowners propane cannons to harass elk during critical times and as budgets allow WDFW has assisted in fencing projects.

Research

The Predator-Prey Project began in the winter of 2016/17 and seeks to quantify the effects of recolonizing wolf populations on co-occurring ungulate species and another top predator, the cougar. The two primary objectives of this project are to 1) examine the effects of wolf predation on ungulate demography and population growth and 2) investigate the impacts of recolonizing wolves on cougar population dynamics, space use, and foraging behavior. This project consists of two study areas; one in northeast Washington encompassing the majority of Stevens and Pend Oreille counties, where the wolf population is larger and more widely distributed, and the other in Okanogan county in north-central Washington where the wolf population is smaller and portions of suitable habitat remain unoccupied. There is increasing understanding that a multi-species approach to predator-prey studies is relevant to account for the various interactions among apex predators and their prey.

To implement a system-based approach, the Department and University of Washington project personnel are attempting to capture and radio-collar 50 elk and 65 white-tailed deer in NE Washington, 100 mule deer in the Okanogan, and 10 cougars in each study area. The project will also attempt to maintain at least two active GPS collars on wolves in each project study pack. Ungulate capture efforts began in late-January 2017, and the capture crew was able to collar 34 elk in GMUs 117 and 121. The additional elk were captured and collared in the winter of 2017/18 for a total of 50 collared elk.

During March of 2018 and 2019, WDFW biologists conducted aerial composition surveys by locating collared cows and classifying elk observed in the vicinity. Biologists counted a total of 414 elk in 2018, which resulted in an observed calf:cow ratio of 30 calves per 100 cows. During the second year of flights, WDFW biologists counted 419 elk and an observed calf:cow ratio of 22 calves per 100 cows.

Management Concerns

Federal, state, and private land managers have implemented numerous road closures in recent years that have likely benefited this herd by reducing human disturbance in areas that provide quality elk habitat.

The special permit hunt on TNWR was created to address habitat damage by elk on the Refuge. Elk counts were low during the annual aerial survey in the Turnbull area the past three years. However, reported sightings and increased damage complaints to agricultural crops in the area suggest this was due in part to movement of elk out of the area in response to drought and hunting pressure rather than a true population decline. Future surveys will consider revising the survey area to reflect recent known activities of these elk. The Department will continue to work with TNWR to assess the hunt and if it is accomplishing its objectives.

Management Conclusions

According to harvest estimates and public perception, elk numbers seem to be either stable or slightly increasing within the Pend Oreille sub-herd area. Recent wildfires will likely improve habitat conditions that favor elk.

According to harvest estimates and landowner perceptions, elk numbers seem to be increasing within the Spokane sub-herd area. The Department will continue to allow harvest of any elk during the general season for all weapon types in the Spokane sub-herd range, as well as GMU 124 in the Pend Oreille sub-herd range, to help balance these elk populations with landowner tolerance.

Literature Cited

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

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

Washington Department of Fish and Wildlife, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Washington Department of Fish and Wildlife, Ellensburg, WA, USA.

South Rainier Elk Herd

Eric Holman, Wildlife Biologist

Introduction

The South Rainier elk herd is located in west-central Washington and consists of 5 GMUs, which includes 503 (Randle), 510 (Stormking), 513 (South Rainier), 516 (Packwood), and 667 (Skookumchuck) (Figure 1).

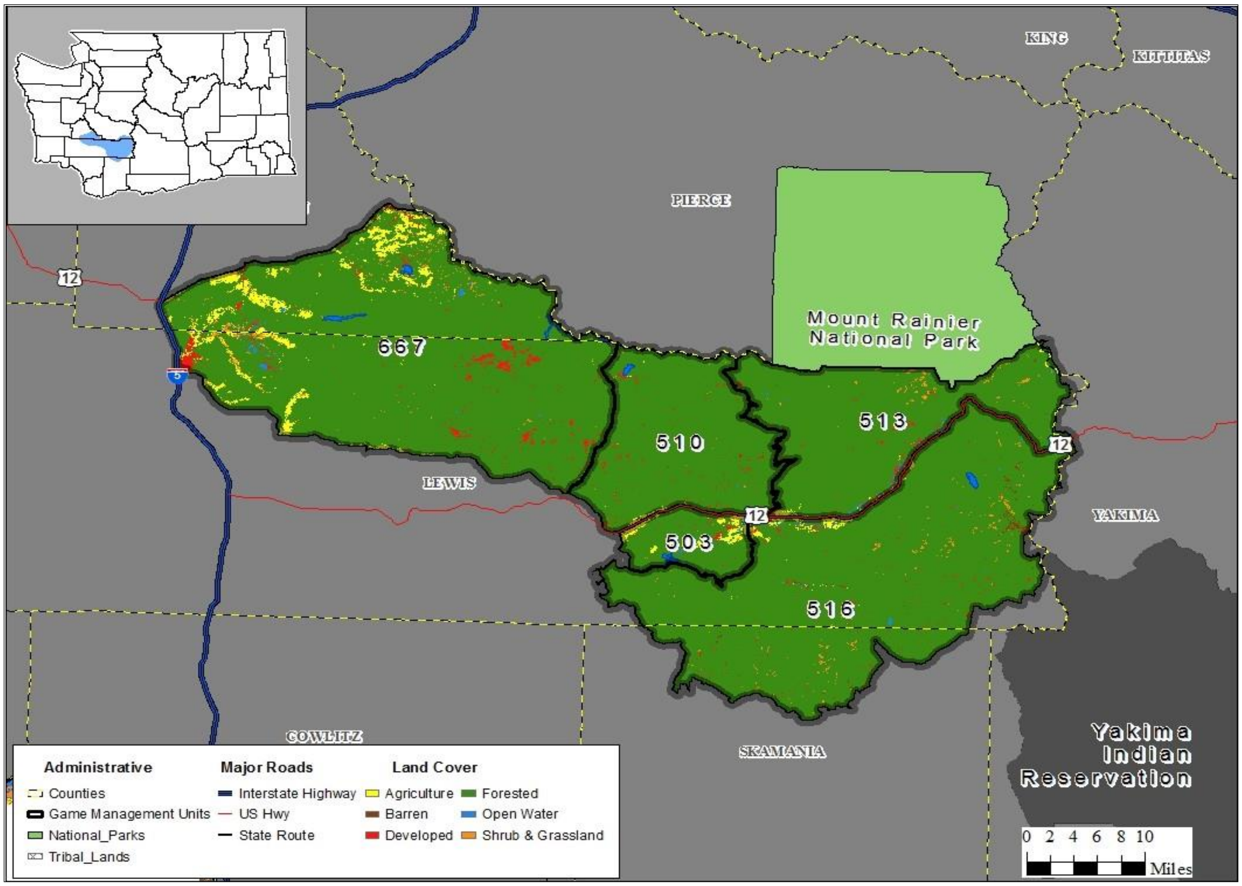

Figure 1. Dominant land use cover types within the 5 game management units that comprise the South Rainier elk herd area.

Management Guidelines and Objectives

The Department identified a management objective of 3,000 elk in the South Rainier Elk Herd Plan (WDFW 2002); however, the plan is overdue for a revision and management objectives may be out of date. In addition, the Department has not identified a formalized monitoring strategy to estimate elk abundance and herd composition in the South Rainier elk herd area. Because the Department has not identified a comprehensive monitoring strategy that is representative of the entire herd, we primarily depend on harvest data to make inferences about population trend.

Population Surveys

The Puyallup Tribe of Indians conducts aerial composition surveys and estimates elk abundance in the upper Cowlitz River basin using a sightability model they developed specific to that area (Gilbert and Moeller 2008). The surveys are conducted in early spring and include portions of GMUs 503, 510, 513, and 516. The results of these surveys are illustrated in Figure 2 (Moeller 2019).

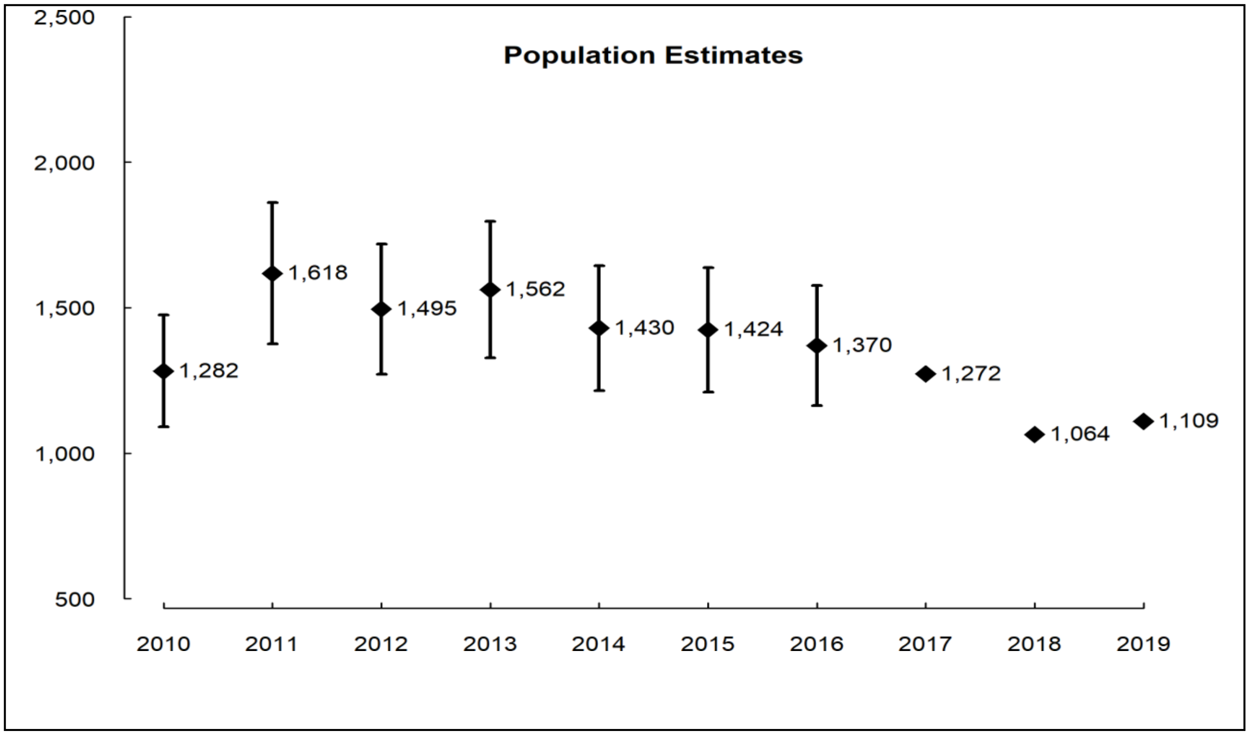

Figure 2. Sightability corrected estimates of total elk abundance in the Cowlitz River Basin (portions of GMUs 503, 510, 513, and 516), spring 2010-2019. Data are collected and provided by the Puyallup Tribe of Indians.

The Department has also collaborated with the Muckleshoot Indian Tribe, the U.S. Geological Survey, National Park Service, and Puyallup Tribe of Indians to estimate elk abundance in the high alpine meadows of Mount Rainier National Park (MRNP) (Griffen et al. 2013). However, those surveys only include a small portion of the South Rainier elk herd (<550 elk). Additionally, it is unknown what proportion of those elk move outside MRNP, what portion may join either the Yakima or North Rainier elk herds, or what portion could be included in the spring survey conducted by the Puyallup Tribe.

The Department has also periodically conducted surveys on the Centralia Mine portion of GMU 667 since 2010. The survey was most recently completed in September of 2019. The effort resulted in observations of 199 elk with a bull:cow ratio of 29:100 and a calf:cow ratio of 27:100.

Hunting Seasons and Recreational Harvest

The Department limits most general season harvest opportunities in the South Rainier elk herd area to branch-antlered bulls. Opportunities to harvest antlerless elk do occur during some general archery and muzzleloader seasons within GMUs 503 and 667 and by permit in areas where the Department's objective is to maintain low elk numbers.

Estimates of annual harvest during general seasons and total harvest have averaged 273 and 382 elk, respectively, 2009-2018. Harvest estimates varied annually 2008-2012 but have been more stable in recent years (Figure 3).

Figures 4 and 5 respectively display the percentage of antlered and antlerless elk harvest that occurred during general and permit seasons established by the Department and during established tribal seasons.

Estimates of hunter effort have been stable during 2011-2018 (Figure 6). Estimates of hunter success (expressed as catch per unit effort; CPUE) varied annually 2009-2012 but stabilized during 2013-2018 (Figure 7).

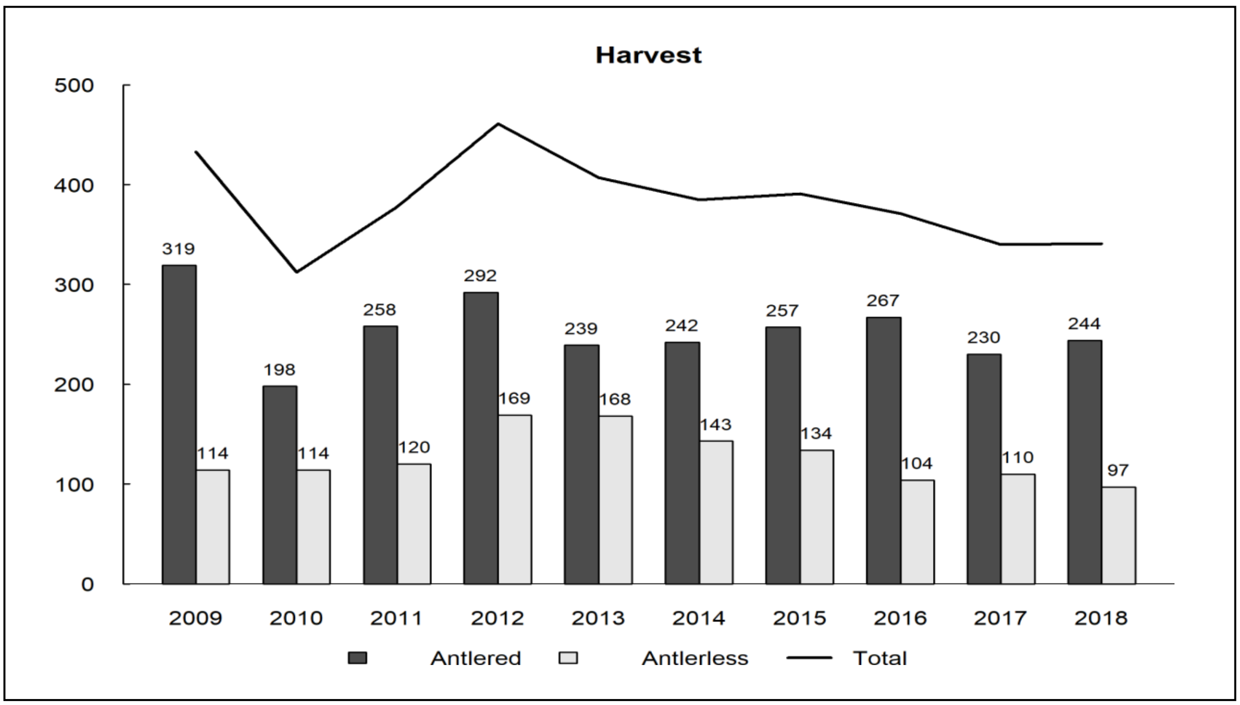

Figure 3. Estimated number of antlered and antlerless elk harvested in the South Rainier elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department and during established Tribal seasons, 2009-2018. Estimates of Tribal harvest were derived from annual harvest reports compiled by the Northwest Indian Fisheries Commission. Estimates do not include elk harvested in association with damage permits (see Human Wildlife Interaction below).

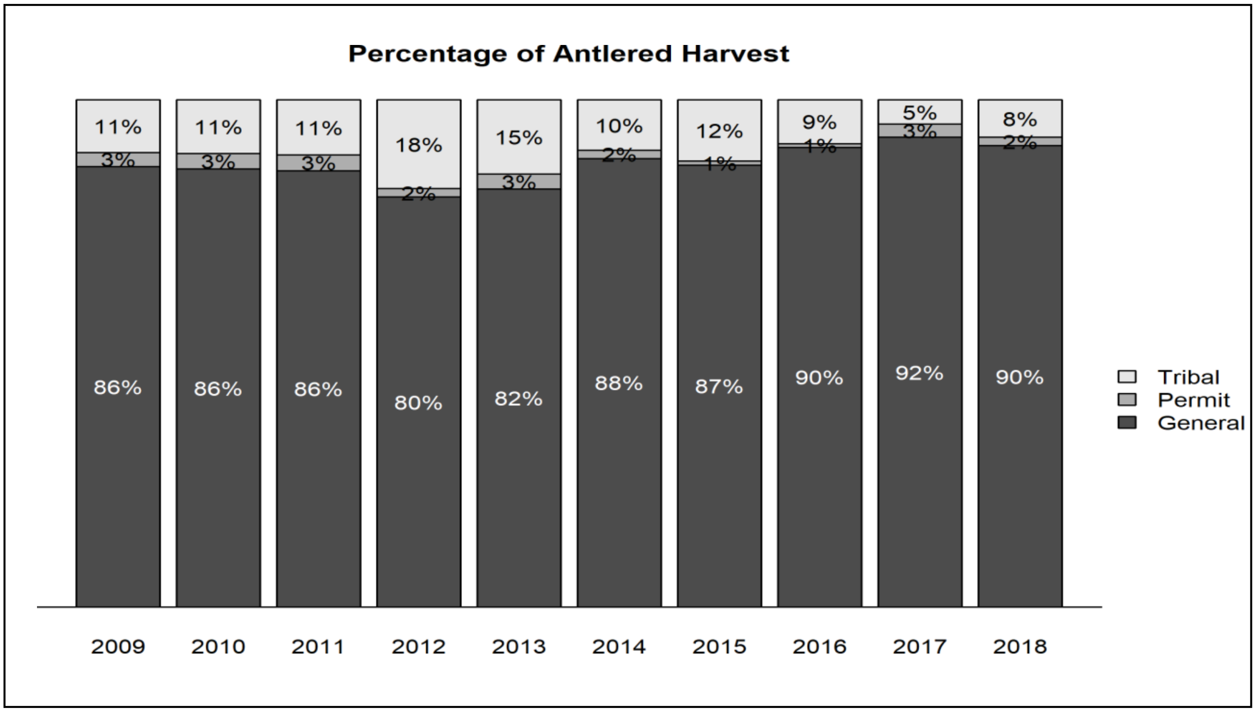

Figure 4. Estimated percentage of recreational antlered harvest in the South Rainier elk herd area that occurred during general and permit seasons and the percentage of harvest that occurred during established tribal seasons, 2009-2018.

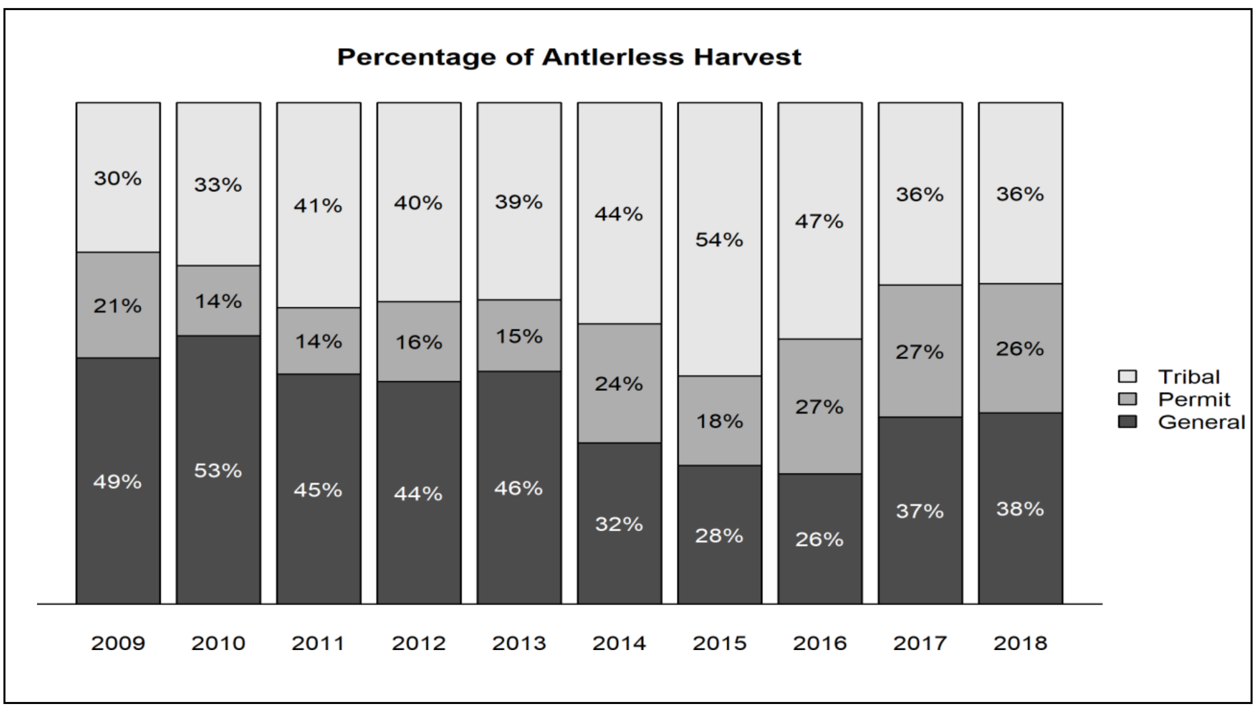

Figure 5. Estimated percentage of recreational antlerless harvest in the South Rainier elk herd area that occurred during general and permit seasons and the percentage of harvest that occurred during established tribal seasons, 2009-2018.

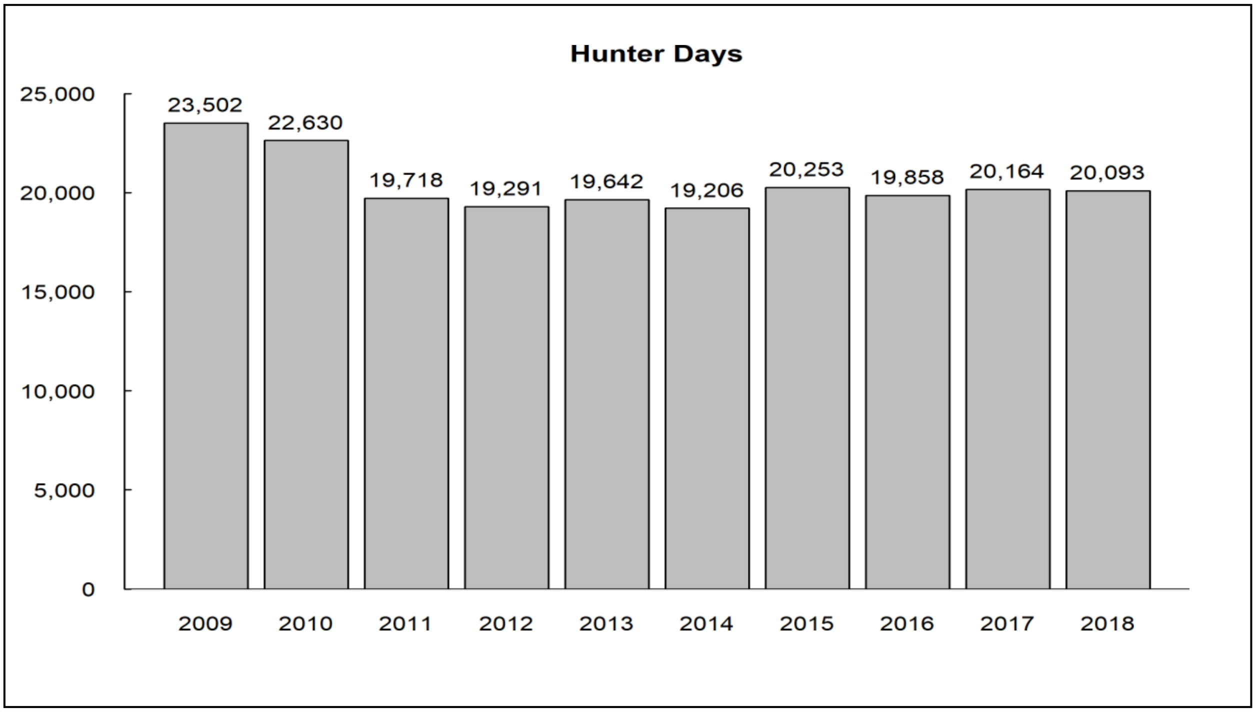

Figure 6. Estimated number of days hunters spent pursuing elk in the South Rainier elk herd area during recreational seasons that provided general over-the-counter opportunities, 2009-2018.

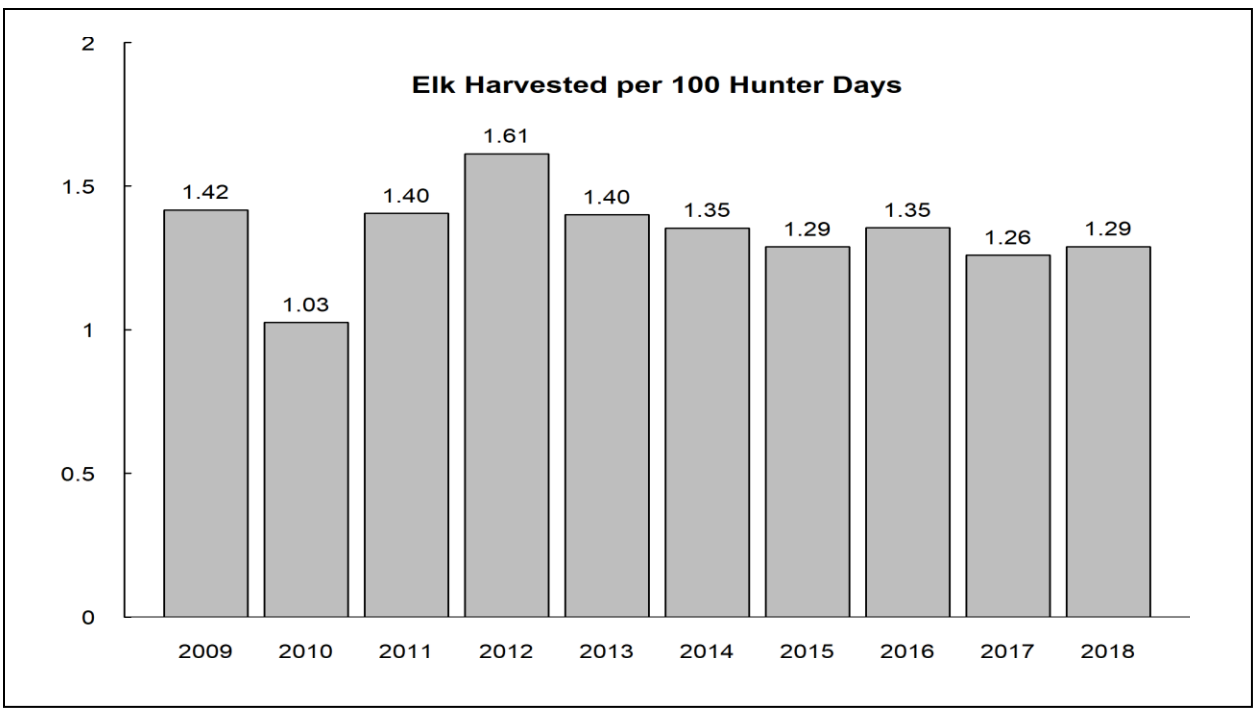

Figure 7. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the South Rainier elk herd area during recreational seasons that provided general over-the- counter opportunities, 2009-2018.

Survival and Mortality

Common predators of elk that occur throughout the South Rainier elk herd area include black bears and cougars. At the time of this writing, there were no documented wolf packs within the herd area (WDFW et al. 2019) although wolf sightings are being investigated (M. Tirhi pers. comm.).

Severe winter events are thought to rarely affect the South Rainier elk herd. However, extreme drought conditions that persist through summer and fall have the potential to reduce the availability of high-quality forages that elk rely on to accrue adequate fat stores for winter.

There haven't been recent studies to monitor the survival of elk in the S. Rainier elk herd area.

Habitat

The majority of the South Rainier elk herd area consists of lands administered by the U.S. Forest Service (USFS). The remainder of the herd area is comprised of private industrial forestland, State Department of Natural Resources (DNR) forestland, national park land, agricultural areas, and suburban/rural residential land use. The herd continues to benefit from the creation of early seral habitats on private industrial forests and DNR forests.

The industrial forestlands consist of a mosaic of clearcuts, relatively open young regeneration stands, dense second growth stands of timber, and stream buffers lined with second-growth forest. Industrial timber management practices benefit elk by increasing the quantity of early seral habitats and the subsequent forage base. While beneficial to elk, management practices are not conducted to purposefully increase or improve elk habitat. Additionally, intensive forest management practices including the planting of dense stands of fast-growing conifer seedlings and the application of herbicides during re-establishment of the timber stand may also be affecting overall productivity due to reduced forage quality and availability. These effects work in tandem by reducing the amount of favorable plants available as forage in the early term and completion of forest canopy closure (typically approximately age 12), far earlier than would occur in a naturally regenerated stand. The magnitude of those effects is influenced by site specific types of post-timber harvest treatments and plant compositions; and the number of years since timber harvest. A commonality among all of these varying factors is that the best quality and most quantity of favorable forage seems to occur approximately 3 to 14 years after timber harvest whether herbicide treatments are applied or not. However, the differences between available, favorable forage in that time period for treated and untreated stands can still be substantial. A full discussion on the complexity of these habitat interactions is beyond the scope of this report and we refer the reader to Ulappa (2015) and Geary et al. (2012) for a more comprehensive understanding of this research.

In contrast, very limited timber harvest on federal forests in the last three decades has led to a generally declining trend in habitat quality for elk. Forest thinning projects have partially offset the losses of quality habitat on USFS lands. These projects have been cooperative efforts among the Puyallup Tribe, the Rocky Mountain Elk Foundation, and USFS. Since 2004, 1,726 acres have been enhanced through thinning, weed treatments, and slash piling. Additional thinnings are scheduled for 2019 (Moeller, 2019).

A large number of elk in the South Rainier elk herd area concentrate on the valley floor in the Upper Cowlitz River Basin during winter. However, the continued development of this area for agricultural, recreational, and housing purposes continues to result in a loss of critical winter habitat. Currently, elk numbers in the Upper Cowlitz River Basin are higher than some segments of the public would prefer.

Human-Wildlife Interaction

Complaints of damage to agricultural crops occur within the range of the South Rainier elk herd. The most severe conflicts are concentrated in the upper Cowlitz River valley and the Hanaford area. In the upper Cowlitz River, a narrow band of low-elevation privately owned land is surrounded by mountainous and forested public and industrial forestland. The upper Cowlitz valley is winter range for elk, and their presence is most common in winter and early spring but persists year-round. Elk damage complaints in this area have persisted for many years and are unlikely to be abated given the juxtaposition of attractive food sources and large amount of forestland. A variety of crops are impacted by elk damage, but most of the damage is on hay fields.

In the Hanaford Area of Lewis County, elk also cause damage to agricultural crops. Elk populations that move between the Centralia Mine and the Skookumchuck Wildlife Area have been increasing over the years. Access to the Centralia Mine is restricted by federal regulations, which reduces the number of elk that may be harvested there. However, the landowner has worked with WDFW to allow senior and disabled special draw permit hunts to help control this elk population. Additionally, three permit-only elk seasons, designed to address agricultural damage, have been implemented in the Hanaford elk area (Elk Area 6069).

Wildlife Conflict Specialists work closely with agricultural producers by developing Damage Prevention Cooperative Agreements (DPCAs), which identify a plan to reduce the amount of damage incurred to 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. Conflict Specialists and landowners use a variety of non-lethal methods including electrified fladry fencing; noisemakers (bird bangers, critter gitters, propane cannons); hazing and herding on foot, with a vehicle or dog; scarecrow-like electronic devices; and odor-based repellents such as Plantskyyd.

Lethal methods of deterring elk are also used to reduce damage to crops. These efforts include hunts within specified elk areas, pools of Master Hunters, Youth and Hunters with Disabilities for immediate response to damage issues, as well as landowner damage permits. See Table 1 for a summary of permits issued to landowners allowing the taking of elk causing agricultural damage in the South Rainier elk herd area during 2018-19. Note: These removals are in addition to the elk harvests discussed in Hunting Seasons and Recreational Harvests above. Collectively, these hunts are designed to decrease the number of elk causing damage and/or to haze elk from the area.

Table 1. Number of Permits to lethally remove elk causing damage to agricultural crops and resulting number of elk removed, South Rainier elk herd, 2018-19.

Game Management Unit	Permits Issued	Elk Removed
503	7	6
513	6	2
516	16	12
667	19	10
Total	48	30

In addition to conflicts with agriculture, elk in the Upper Cowlitz River Valley are regularly in close proximity to people. This situation is most acute in the town of Packwood where elk are abundant within the city limits, presenting a challenging scenario where many residents very much enjoy the presence of the animals, but others do not. A County ordinance does not allow the use of firearms in town, so these animals are largely not hunted, which has created a refuge effect allowing the elk to feed and loaf in town without fear of humans. Because the elk are somewhat habituated to people, direct interaction among elk and people is not uncommon. Additionally, the elk commonly present a hazard along State Highway 12.

Management Concerns

Treponeme-associated hoof disease

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. Elk severely affected by TAHD often have reduced mobility and condition. Consequently, it seems reasonable to assume they would have a reduced probability of survival or reproductive potential. However, it is unknown how TAHD affects the population dynamics of herds where TAHD occurs; this is the focus of ongoing research. The Department is also conducting research to better estimate the distribution and prevalence of TAHD. To learn more about the Department's efforts associated with investigating TAHD, please visit the Department's hoof disease webpage at: https://wdfw.wa.gov/species-habitats/diseases/elk-hoof

Habitat Conditions on Federal Lands

Habitat conditions on federally managed lands within the South Rainier Elk herd area are of concern. Large-scale fire, timber harvest, disease, or other succession resetting events are largely absent from the federal lands. The resulting landscape is dominated by closed-canopy forest, much of which was harvested from roughly 1950-1990 and subsequently replanted with dense Douglas fir trees. These stands provide little in the way of elk forage and lack the diversity and forage resources of either older or younger forests. While some forest thinnings have been completed and do provide more robust forage resources at least temporarily, elk forage and likely elk populations will continue to be suppressed in GMUs 513 and 516.

Fee-Only Hunting Access Restrictions

The largest industrial forestland owner within the South Rainier elk herd area implemented a fee-only access system for hunting and other recreation on their lands several years ago. This system limited the number of individuals allowed access to these lands and has continued in the years that have followed. The ramifications of this limited access to elk hunting opportunity are difficult to quantify as the landowners don't own entire Game Management Units, some individuals elect to pay the access fee, some individuals elect to hunt in another area, and some may decide to quit hunting. The effects of reduced hunter access and participation are twofold in as much as it impacts the Department's goals to maximize recreational access to wildlife and likely reduces hunter participation and recruitment, therefore undermining capacity to manage elk and other wildlife.

Conflict with Agricultural Land Uses in the Upper Cowlitz River Valley

The situation of conflict among agricultural land uses and elk in the Upper Cowlitz River Valley is not likely to conclude in the near term. The close proximity of relatively abundant elk on forestlands surrounding the valley with attractive food resources likely guarantees that these conflicts will continue. Furthermore, large-scale habitat changes such as forest fires or extensive timber harvest on the federal lands, which could generate improved habitat conditions and draw elk away from the valley floor, are unlikely to occur in the near future. However, the forest industry including the USFS have begun to reconsider fuel loading and fire management practices in the face of the megafires of the 21st century (Natl. Acad. Sci., Eng., Med. 2017). Large amounts of funding that would be needed for extensive fencing of agricultural areas is not available and even if funding were available, installation of large-scale fencing would restrict wildlife movement, require maintenance, and be aesthetically unappealing.

Management Conclusions

Harvest data, WDFW winter surveys, spring surveys conducted by the Puyallup Tribe of Indians, and surveys of alpine habitats on the south side of Mt. Rainier National Park all indicate a stable elk population. While none of these methods provides a comprehensive index of elk abundance in the South Rainier herd area, together they do serve as a surrogate means of monitoring the population. Nonetheless, development and implementation of a method to monitor the entirety of the South Rainier elk herd including demographic characteristics (i.e., bull and calf to cow ratios) is a management need.

Conflicts with agricultural producers, especially in the Upper Cowlitz River Valley and the Hanaford area are ongoing and will require continuing attention from Wildlife Conflict staff. Additionally, the development of bacterial hoof disease in southwest Washington elk has the potential to impact elk in the South Rainier herd area. The extent of the disease in the South Rainier herd area is not known, but the condition is extensive in both the Mount St. Helens herd area and Willapa Hills herd areas to the south and west.

An updated herd plan is needed for the South Rainier herd. The existing plan is now more than 15 years old and does not reflect current conditions. Specifically, the plan was written before the presence of hoof disease in southwest Washington elk and prior to the organizational change of hiring wildlife management staff to specifically address wildlife-human conflicts. Finally, the existing plan prescribes an elk population goal of 3,000, but there is no method currently available to monitor the entire population.

Literature Cited

Geary, A.B., J. G. Cook, R. C. Cook, and E. H. Merrill. 2012. Herbicide and Herbivory Effects on Elk Forages at Mt. St. Helens. Final research report. University of Alberta and National Council for Air and Stream Improvement. 44 p.

Gilbert, B. A. and B. J. Moeller. 2008. Modeling elk sightability bias of aerial surveys during winter in the central Cascades. Northwest Science, 82:3, 222-228.

Griffin, P. B. Lubow, K. Jenkins, D.Vales, B. Moeller, M. Reid, P. Happe, S. McCorquodale, M.Tirhi, J. Schaberl, K. Beirne. 2013. A Hybrid Double-Observer Sightability Model for Aerial Surveys. The Journal of Wildlife Management 77(8):1532–1544.

Moeller, B. 2019. Elk Status and Trend Report: Region 5. Unpublished Data. Puyallup Tribe of Indians.

National Academies of Sciences, Engineering, and Medicine. 2017. *A Century of Wildland Fire Research: Contributions to Long-term Approaches for Wildland Fire Management: Proceedings of a Workshop*. Washington, DC: The National Academies Press. https://doi.org/10.17226/24792.

Ulappa, A. 2015. Using foraging dynamics to answer landscape management questions: the nutritional ecology of black-tailed deer. Dissertation, Washington State University, Pullman, WA, USA.

Washington Department of Fish and Wildlife, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Washington Department of Fish and Wildlife, Wenatchee, WA, USA.

Washington Department of Fish and Wildlife. 2002. South Rainier Elk Herd Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA.

Personal Communications

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Willapa Hills Elk Herd

ANTHONY NOVACK, Wildlife Biologist

Introduction

The Willapa Hills elk herd is located in southwest Washington, which consists of 12 GMUs (Figure 1), includes 501 (Lincoln), 504 (Stella), 506 (Willapa Hills), 530 (Ryderwood), 658 (North River), 660 (Minot Peak), 663 (Capitol Peak), 672 (Fall River), 673 (Williams Creek), 681 (Bear River), 684 (Long Beach), and 699 (Long Island). The herd area covers more than 1.7 million acres, of which approximately 22% is in public ownership and 78% is in private ownership. Most of the herd area is industrial forestland, which is owned by a variety of private corporations. Small private timber holdings and small farms occur along the major drainages.

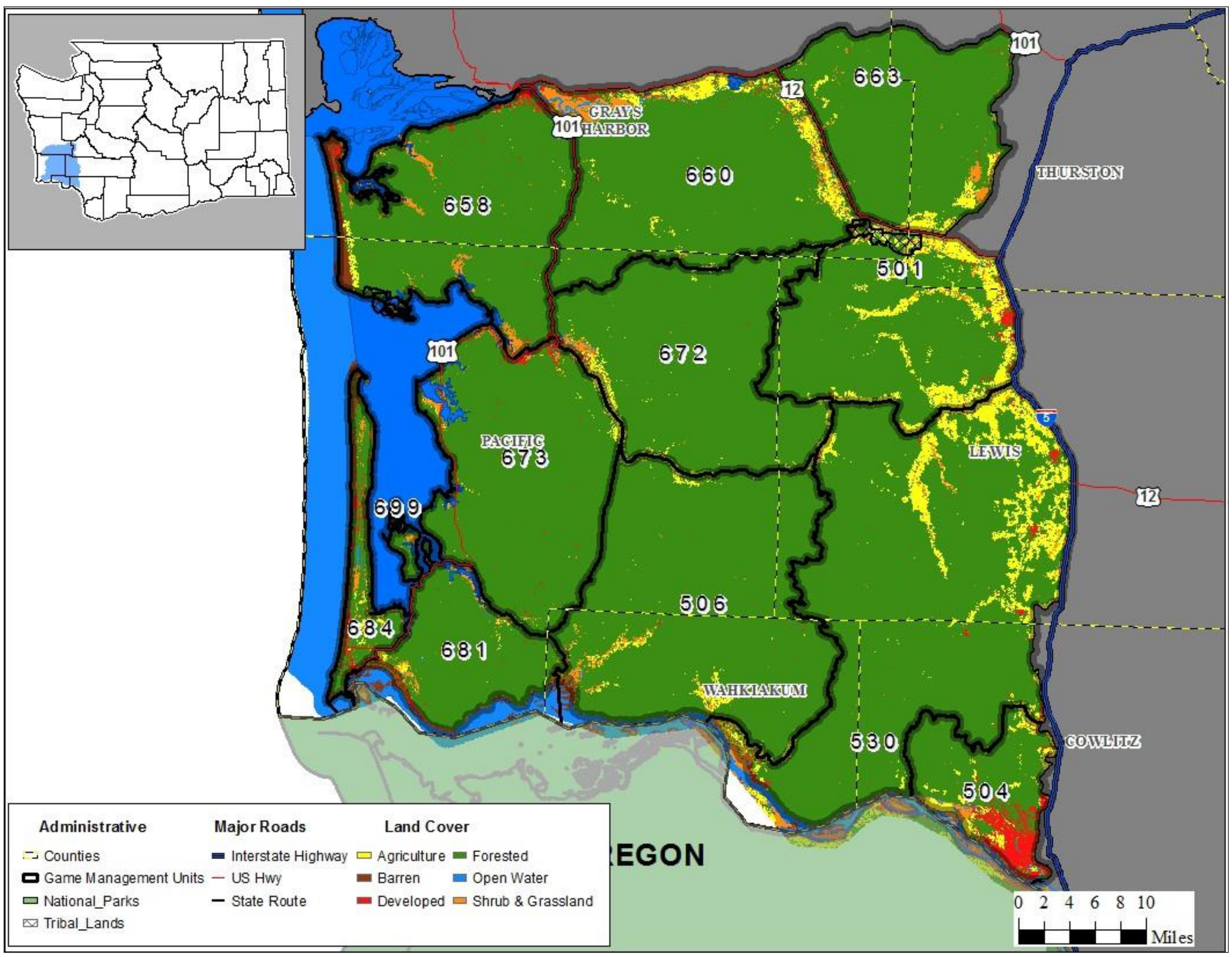

Figure 1. Dominant land use cover types within the 12 game management units that comprise the Willapa Hills elk herd area.

Management Guidelines and Objectives

The Department completed the Willapa Hills Elk Herd Plan in 2014 and identified a population objective of managing this herd for a stable to increasing population (WDFW 2014a). Additional objectives include managing for a pre-hunt population with 15-35 bulls:100 cows or a post-hunt population with 12-20 bulls:100 cows and maintaining an annual survival rate of 0.50 for bulls when bull mortality is monitored (WDFW 2014b).

Population Surveys

Historically, the Department conducted pre-hunt (August-September) or post-hunt (March-April) aerial composition surveys to assess trends in age and sex ratios. However, surveys lacked a formalized sampling design and did not account for biases that are commonly associated with observing elk in densely vegetated habitats (Samuel et al. 1987). Consequently, estimated ratios were not reflective of the entire herd and were likely biased (WDFW 2014a).

In 2014, the Department initiated a formalized sampling design to index total elk abundance across the entire herd area using a sightability model developed for elk in the Mount St. Helens elk herd area (McCorquodale et al. 2014). This design contains two distinct survey areas separated by the Willapa River Valley that will each be surveyed biannually.

WDFW conducted surveys during March of 2019 in the northern half of the Willapa Hills Elk herd area, specifically portions of GMUs 658, 660, 672 and 501. We observed 889 elk during the 2019 survey. The total estimated elk abundance for this portion of the herd area was 1,435 (95% CI= 1,192-1,982). Observed bull to cow ratios averaged 23 bulls per 100 cows (95% CI = 16-30). This 23:100 statistic is well above the 12 bulls per 100 cow minimum that WDFW uses to benchmark breeding success. Calf to cow ratios measured 45 calves per 100 cows (95% CI = 34-55). This calf ratio indicates good elk production. Mature bulls, carrying antlers with five points or more, were uncommon (<10% of total).

In spring 2018, elk abundance was estimated for the survey area that encompasses the southern portion of the herd area (GMUs 506, 530, 673, and 681). The Department estimated total elk abundance to be 2,863 (95% CI = 2,555-3,273) elk. Resulting estimates of post-hunt bull:cow and calf:cow ratios were 22:100 (95% CI = 17-26) and 33:100 (95% CI = 29-37), respectively. Bull to cow and calf to cow ratios obtained since 2013 are presented in Figures 2 and 3).

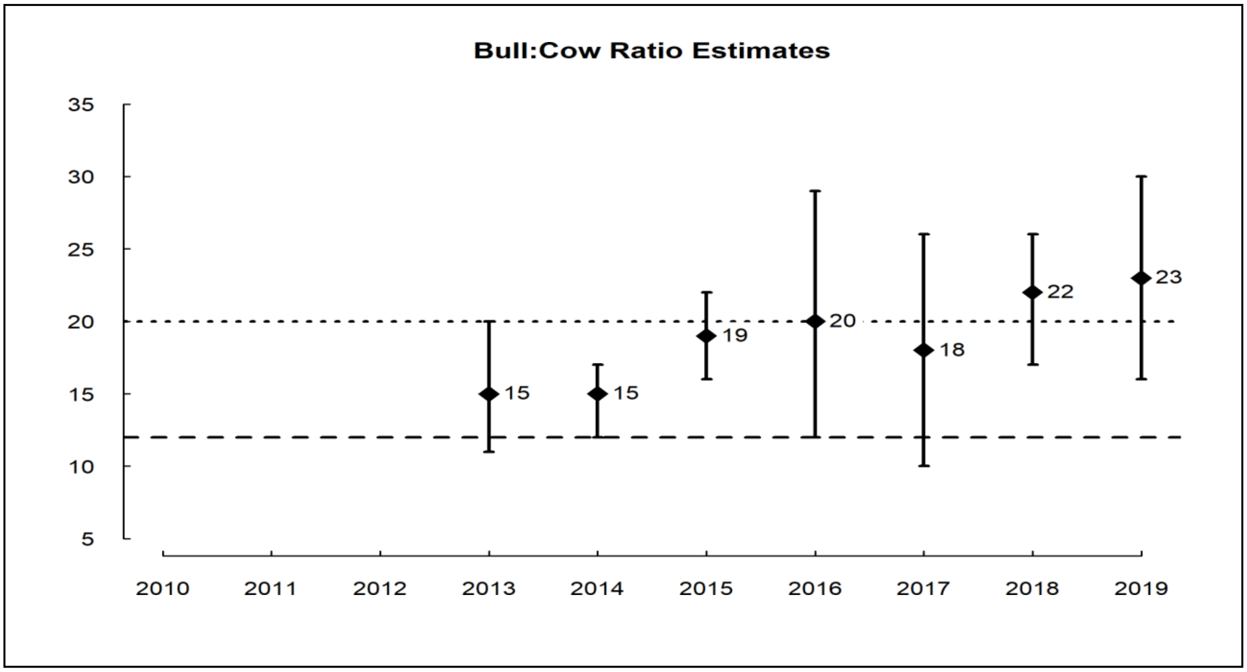

Figure 2. Estimates and associated 95% confidence intervals of post-hunt bull:cow ratios in the Willapa Hills elk herd area, spring 2010-2019. The dashed lines represent the objective range of 12-20 bulls:100 cows. Post-hunt ratios were not comprehensively estimated prior to spring 2013. Estimates were derived from data collected in the South Willapa survey area (GMUs 506, 530, 673, and 681) in 2013, 2014, 2016, and 2018 and from the North Willapa survey area (GMUs 501, 658, 660, and 672) in 2015, 2017 and 2019.

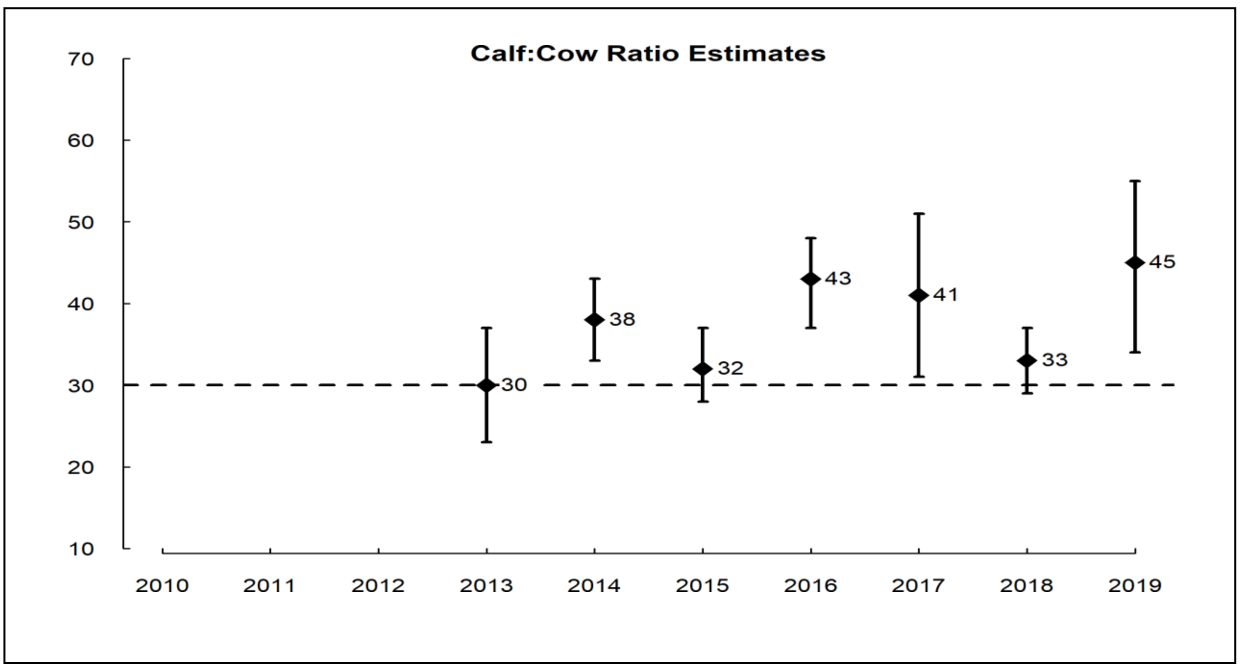

Figure 3. Estimates and associated 95% confidence intervals of post-hunt calf:cow ratios in the Willapa Hills elk herd area, spring 2010-2019. The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth. Post-hunt ratios were not comprehensively estimated prior to spring 2013. Estimates were derived from data collected in the South Willapa survey area (GMUs 506, 530, 673, and 681) in 2013, 2014, 2016, and 2018 and from the North Willapa survey area (GMUs 501, 658, 660, and 672) in 2015,2017 and 2019.

Hunting Seasons and Recreational Harvest

The Department limits most general season harvest opportunities in the Willapa Hills elk herd area to branch-antlered bulls and offers most opportunities to harvest antlerless elk through our permit system. Limited opportunities to harvest antlerless elk occur during general archery seasons or in areas where the Department's objective is to maintain low elk numbers. Total elk harvest, including special permits, averaged 1,334 elk since 2009 (Figure 4). Both general season and total harvest have been generally stable over the ten-year timeframe. No tribal harvest was reported for 2018 and has averaged less than 1% of the overall elk harvest for the past 10 years. Nearly all harvest of antlered elk occurs during general seasons (Figure 5). An estimated 68% of the total antlerless harvest in 2018 was taken by non-tribal general season hunters, while the remaining 35% is attributed to permit hunters (Figure 6). Catch-per-unit-effort (CPUE) or, the number of elk taken per 100 hunter days, has steadily increased since 2009 (Figure 7). Hunter effort has generally declined during that same period (Figure 8).

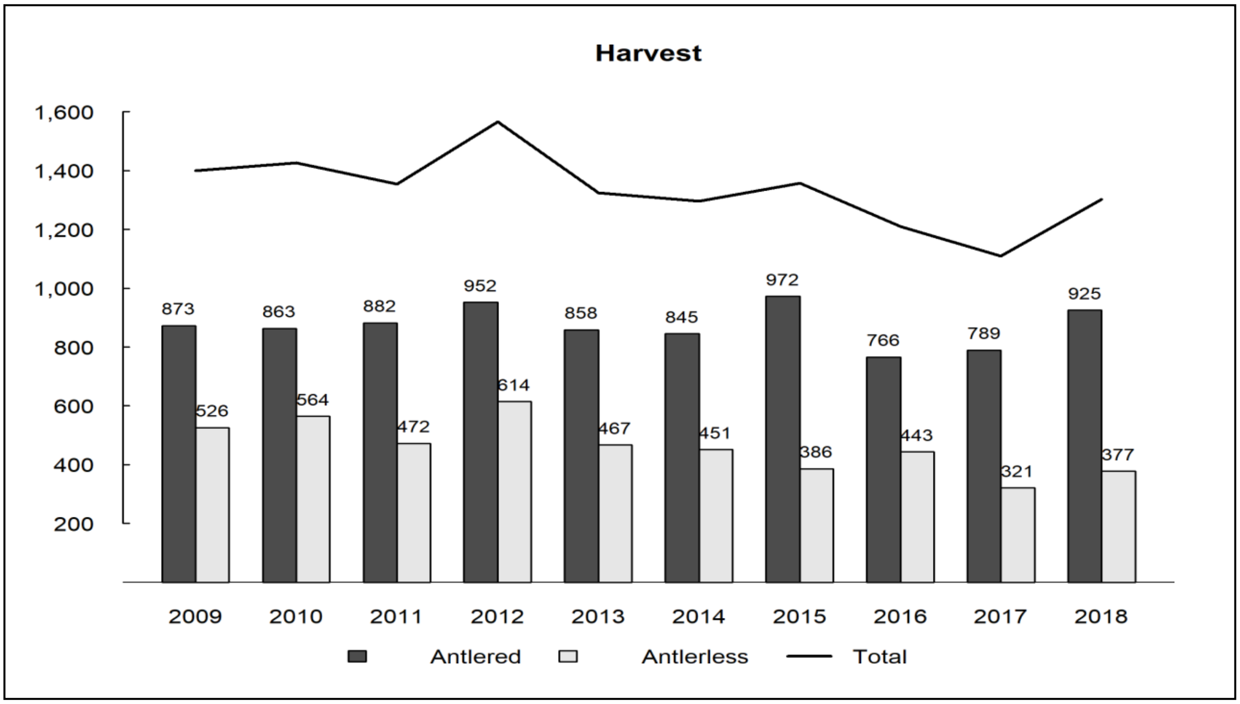

Figure 4. Estimated number of antlered and antlerless elk harvested in the Willapa Hills elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department and during established Tribal seasons, 2009-2018. Estimates of Tribal harvest were derived from annual harvest reports compiled by the Northwest Indian Fisheries Commission. Estimates do not include elk harvested in association with damage permits (see Human Wildlife Interaction below).

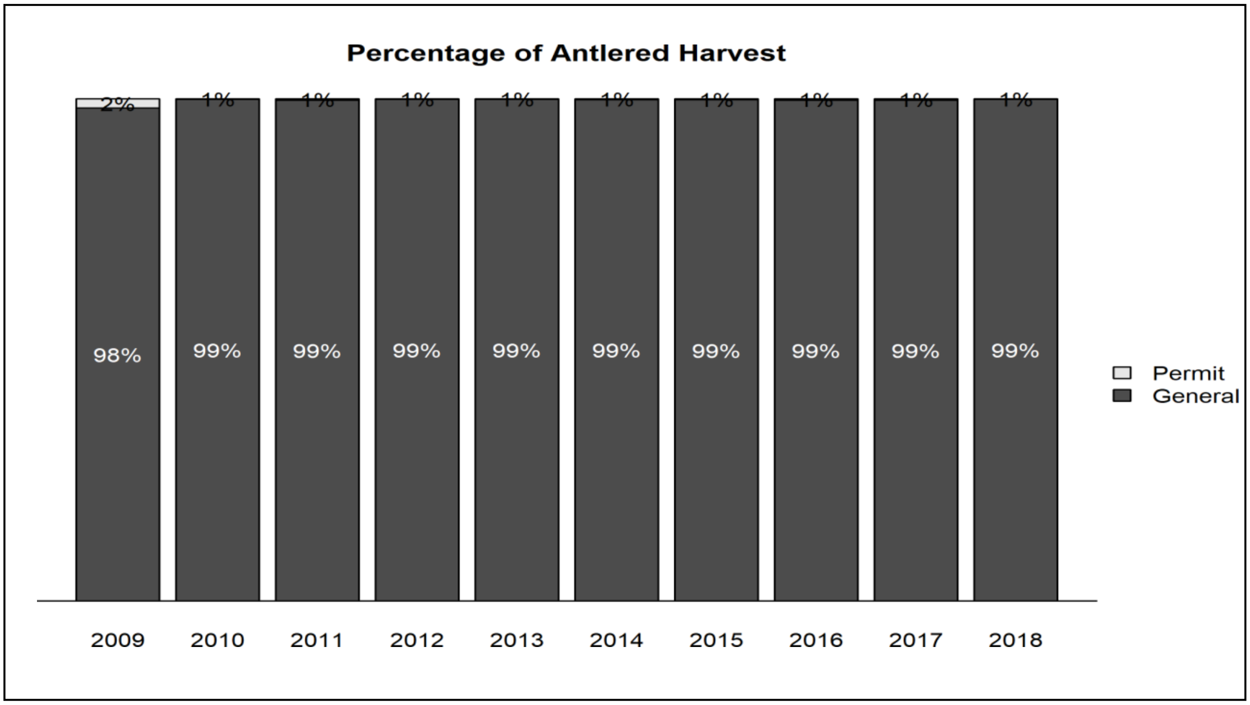

Figure 5. Estimated percentage of recreational antlered harvest in the Willapa Hills elk herd area that occurred during general and permit seasons, 2009-2018. Zero tribal harvest was reported and is not represented in the figure.

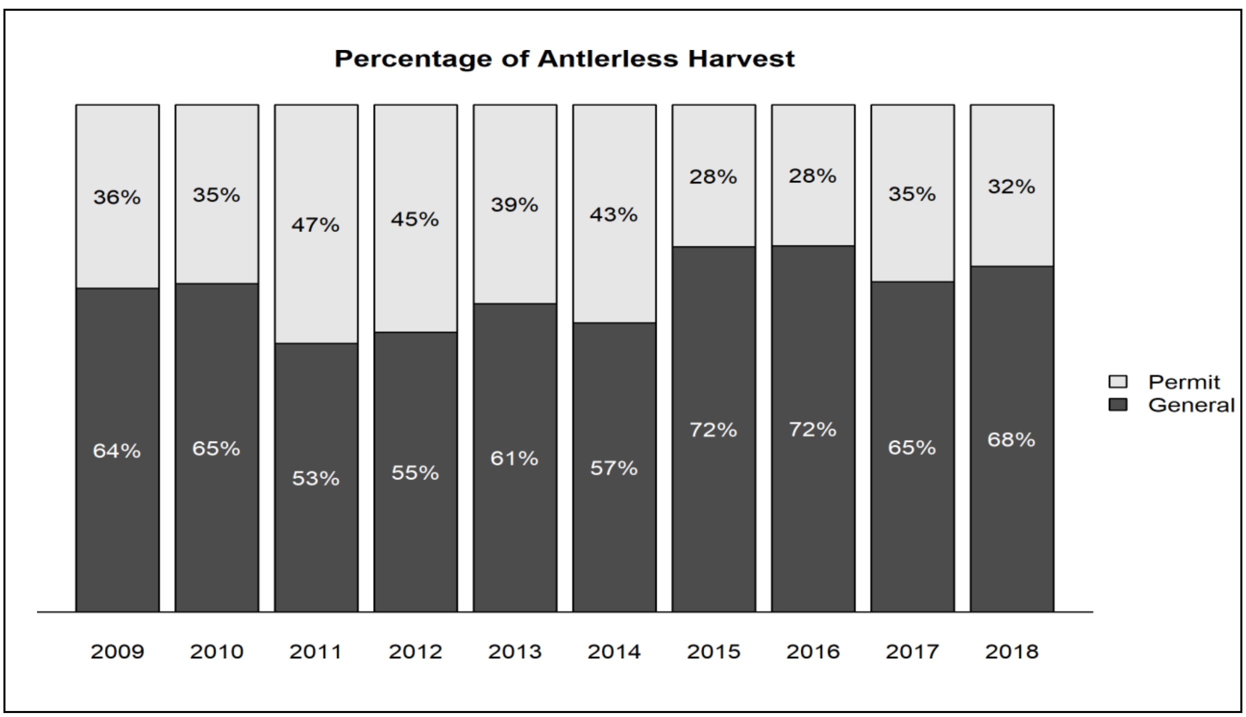

Figure 6. Estimated percentage of recreational antlerless harvest in the Willapa Hills elk herd area that occurred during general and permit seasons, 2009-2018. Zero tribal harvest was reported and is not represented in the figure.

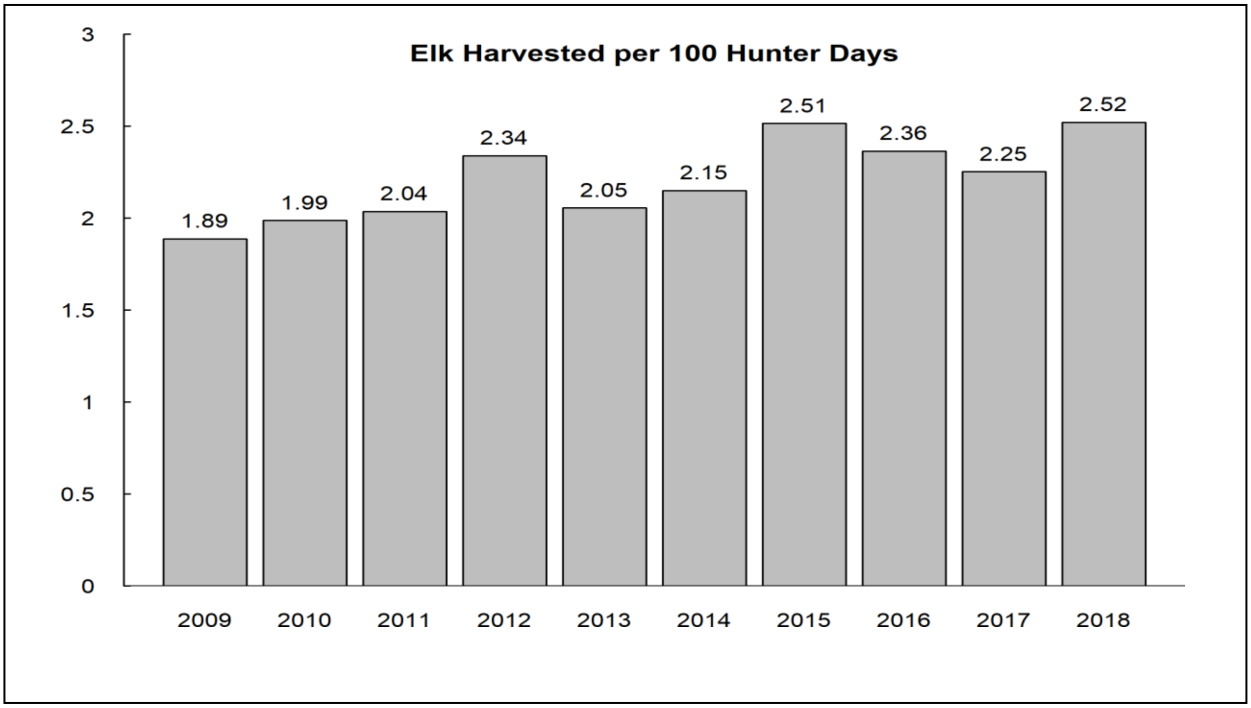

Figure 7. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the Willapa Hills elk herd area during recreational seasons that provided general over-the- counter opportunities, 2009-2018.

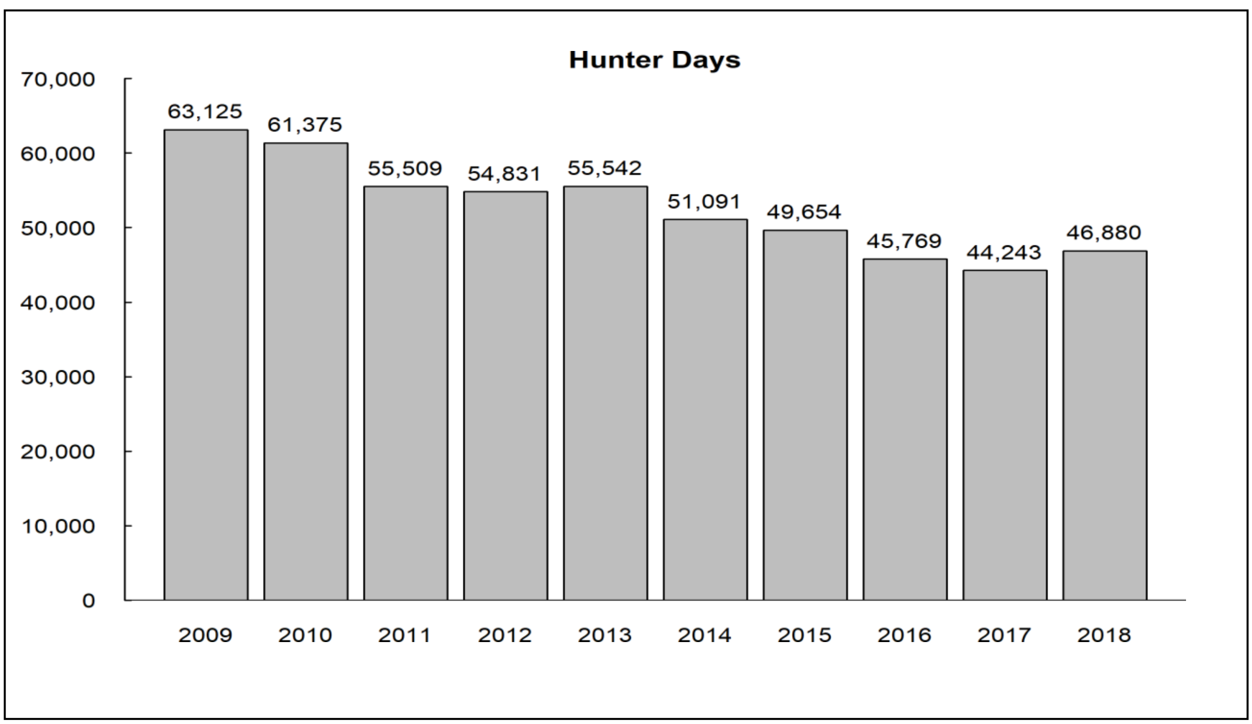

Figure 8. Estimated number of days hunters spent pursuing elk in the Willapa Hills elk herd area during recreational seasons that provided general over-the-counter opportunities, 2009-2018.

Survival and Mortality

Common predators that occur throughout the Willapa Hills elk herd area include black bears and cougars. At the time of this writing, there were no documented gray wolf packs in the herd area (WDFW et al. 2019).

Severe winter conditions rarely occur that affect the overwinter survival of elk in the Willapa Hills elk herd area. However, extreme drought conditions that persist through summer and fall have the potential to reduce the availability of high-quality forages that elk rely on to accrue adequate fat stores for winter.

The greatest source of mortality for bulls in the Willapa Hills elk herd is likely recreational harvest. There have been no comprehensive studies to estimate the survival of elk in the Willapa Hills elk herd area. However, the Department monitored bull survival for 78 adult bulls in GMU 673, 2005-2009 and estimated annual survival to be 0.37 (95% CI = 0.27–0.48), attributing 93% of all mortalities to legal harvest (W. Michaelis, WDFW, unpublished data). Poaching, wounding loss, predation, and malnutrition combined, accounted for <6% of adult bull mortality. Because this study only occurred in GMU 673 and the western third of GMU 506, estimated cause-specific mortality and survival rates may not be representative of the entire Willapa Hills elk herd.

No studies have occurred in the Willapa Hills elk herd area with the specific goal of estimating annual survival rates of cow elk. However, 22 female elk in GMUs 506 and 672 were monitored in 2001 and 2002 as part of a larger study evaluating the relationship between nutritional condition and survival of adult female elk in the Pacific Northwest. During that study Bender et al. (2008) reported a mean annual adult female elk survival rate of 0.92 (95% C.I.= 0.82-0.99).

Habitat

The majority of forestland in the Willapa Hills herd area is managed to maximize revenue from timber production. Both the privately-owned industrial forestlands and a large portion of the publicly owned lands consist of a mosaic of clear-cuts, relatively open young regeneration stands, dense second growth stands of timber, and stream buffers lined with second-growth forest. This mosaic changes on a yearly basis due to ongoing timber cutting operations. Forest management practices on private industrial and state forestlands have generally benefited the Willapa Hills elk herd by creating a mosaic of habitats that increases the forage base for this herd.

Industrial timber management practices have also resulted in a high-density road system that has increased human access to remote areas. A number of large industrial timber company landowners have begun restricting access to their lands. These restrictions can include land leasing and fee permit requirements, which may limit the total number of hunters that access those areas.

Recently, there have been no major changes in the status of elk habitat in the Willapa Hills herd area. 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 within those GMUs.

Human-Wildlife Interaction

Elk damage complaints continue to be a substantial management concern in the Willapa Hills elk herd. Chronic damage persists in several GMUs across the entire elk herd area. Management actions in response to elk conflicts generally increase hunting activity at the focal damage zones. These damage zones can cover an entire GMU or they can be organized into a special Elk Area. Some focal GMUs include 506 (Willapa Hills), GMU 660 (Chehalis River valley), GMUs 672 (Fall River), 673 (Willapa River valley) and GMU 684 (Long Beach). Within these GMUs, some localized elk areas have been created that target crop depredating elk. These elk areas include 5056 (Grays River Valley) and 6010 (Mallis).

Elk damage occurs on Christmas tree farms, hay and silage fields, cranberries, corn, peas, and commercial seed crops such as carrot, Swiss chard, bok choy, and other agricultural crops. Elk also damage agriculture infrastructure such as fences or irrigation systems. Overall reports of elk conflicts to agriculture for 2018 were similar to past years.

Wildlife Conflict Specialists work closely with producers by developing Damage Prevention Cooperative Agreements (DPCAs). These agreements involve nonlethal measures to prevent elk damage and increase 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 DPCAs include a public hunting component to increase pressure on groups of elk causing problems. For 2018-19, Wildlife Conflict Specialists managed at least 42 active DPCAs and worked with many additional landowners without a DPCA. A minimum of 77 elk permits were issued directly to landowners with a DPCA resulting in 27 animals harvested (Table 1).

Table 1: Sum of elk related Damage Prevention and Control Agreements with associated total of elk permits issued and resulting harvest by GMU in the Willapa Hills elk herd area, 2018-19.

Game Management Unit	DPCAs	Permits Issued	Elk Removed
506	6	12	6
530	4	10	5
658	12	22	6
660	2	5	3
663	1	2	0
672	5	8	3
673	3	5	1
681	1	2	1
684	8	11	2
Total	**42**	**77**	**27**

In addition to the use of DPCAs and the issuance of elk permits to landowners, general season regulations may be liberalized to address elk conflicts within an area. Additionally, special permit seasons can be a tool to address elk conflicts within Elk Areas or GMUs. Finally, the Department maintains regional pools of permit hunters that can be deployed to a property incurring agricultural damage. The regional pools of permit hunters are primarily those hunters that have achieved certification as master hunters. Master hunters who draw these permits are deployed directly by WDFW staff to address localized conflicts. Very few elk were harvested within the Willapa Hills elk herd area by this regional pool of permittees.

Research

There is no ongoing elk research being conducted within the Willapa Hills herd area at this time.

Management Concerns

Treponeme-associated hoof disease

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. We find TAHD afflicted elk throughout the majority of the Willapa Hills herd area. Elk severely affected by TAHD often times have reduced mobility and condition. Consequently, they would have a reduced probability of survival or reproductive potential, however, the true effects of TAHD on the population dynamics of herds is unknown. Ongoing research in the Mount St Helens herd area will attempt to identify the specific population level impacts of TAHD on elk.

The Department is also conducting research to better estimate the distribution and prevalence of TAHD. In 2014, a citizen science effort incorporated volunteers to conduct road surveys to locate elk and identify both the number of animals affected and, the geographic distribution of the disease. To learn more about the Department's efforts associated with investigating TAHD, please visit the Department's hoof disease webpage: http://wdfw.wa.gov/conservation/health/hoof_disease/

Private Land Access

Private timber companies own >70% of the Willapa Hills elk herd land base. Consequently, recreational harvest of the Willapa Hills elk herd has largely been dependent on the willingness of these companies to allow hunters access. If these companies chose to preclude hunter access or charge increased fees, recreational hunting will decline. Since 2011, GMUs that had large quantities of private lands transferred to fee-access programs have seen large declines in hunter participation although overall harvest has remained stable.

Management Conclusions

Harvest data indicate the Willapa Hills elk herd has been relatively stable during the period of 2009-2018. Survey data indicate that the Department is meeting or exceeding its management objective of maintaining populations with a post-hunt bull:cow ratio of 12-20 bulls:100 cows. However, the number of mature bulls (5 pt. or better) observed during surveys is generally low. Calf recruitment rates in recent years have been at levels that should promote population stability or growth. While these herd metrics generally indicate a robust and stable elk population; hoof disease, and fee-access systems remain concerns for the Willapa Hills elk herd.

Literature Cited

Bender, L. C., J. G. Cook, R. C. Cook, and P. B. Hall. 2008. Relations between nutritional condition and survival of North American elk Cervus elaphus. Wildlife Biology 14:70–80.

McCorquodale, S. M., P. J. Miller, S. M. Bergh, and E. W. Holman. 2014. Mount St. Helens elk population assessment: 2009–2013. Washington Department of Fish and Wildlife, Olympia, Washington, USA.

Samuel, M. D., E. O. Garton, M. W. Schlegel, and R. G. Carson. 1987. Visibility bias during aerial surveys of elk in north central Idaho. Journal of Wildlife Management 51:622–630.

Washington Department of Fish and Wildlife. 2014. Willapa Hills Elk Herd Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA.

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

Washington Department of Fish and Wildlife, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Washington Department of Fish and Wildlife, Ellensburg, WA, USA.

Yakima Elk Herd

JEFFERY A. BERNATOWICZ, Wildlife Biologist
JASON C. FIDORRA, Wildlife Biologist

Introduction

The Yakima elk herd area is located in central Washington and consists of 11 GMUs, which include 336 (Taneum), 340 (Manastash), 342 (Umtanum), 346 (Little Naches), 352 (Nile), 356 (Bumping), 360 (Bethel), 364 (Rimrock), 368 (Cowiche), 371 (Alkali), and 372 (Rattlesnake Hills) (Figure 1). The Yakima elk herd includes the Rattlesnake Hills sub-herd that is located on the Arid Lands Ecology Reserve (ALE) and surrounding lands in GMU 372. The Yakima elk herd is the only herd in the state where the Department maintains an annual winter-feeding program for elk.

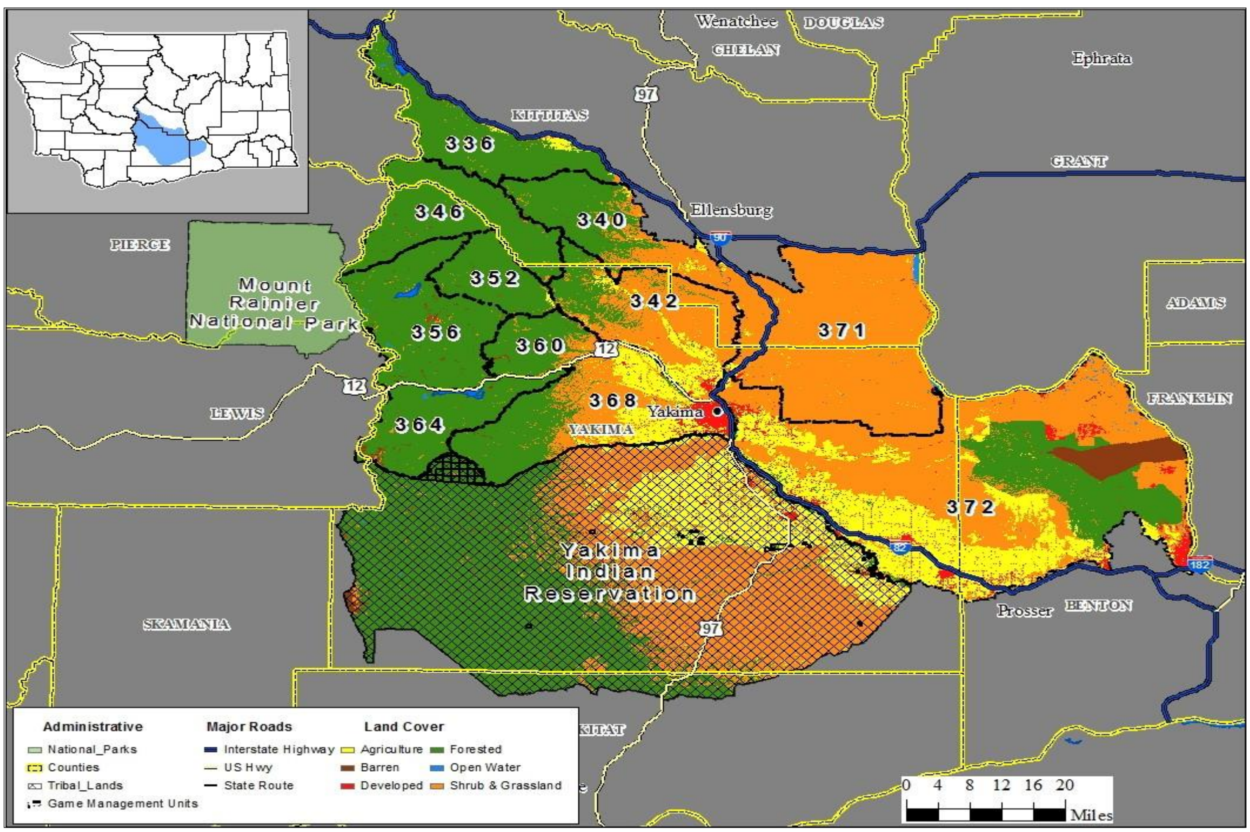

Figure 1. Dominant land use cover types within the 11 game management units that comprise the Yakima elk herd area.

Management Guidelines and Objectives

The Department's current management objective is to manage for a spring population of approximately 9,000-10,000 elk in the greater Yakima elk herd area and <350 elk in the Rattlesnake Hills sub-herd area (WDFW 2002). Additional objectives include managing for a post-hunt sex ratio of 12-20 bulls:100 cows and maintaining an annual survival rate of 0.50 for bulls if bull mortality is monitored (WDFW 2002, WDFW 2014).

Population Surveys

The Department estimates elk abundance in the Yakima herd area in spring by combining ground count data collected at established feed sites with estimates of elk abundance derived from areas adjacent to feed sites. We derive estimates of abundance and ratios in areas adjacent to feed sites by conducting helicopter surveys and using a sightability correction model developed for elk in Idaho to correct observed data for biases associated with effects of cover and group sizes (Unsworth et al. 1999). The Department does not conduct aerial surveys when mild winter conditions fail to concentrate elk at lower elevations (2014, 2015, 2018).

In February 2019, the Department estimated elk abundance within the survey area to be 8,267 elk (Figure 2), which is below objective. The bull:cow ratio has decreased in recent years (Figure 3). The decrease is due to harvest exceeding recruitment. Estimates of post-hunt calf:cow ratios were relatively stable 2007-2016 but fell to a record low of 22 calves per 100 cows in 2017 (Figure 4). Calf recruitment rebounded somewhat in 2018 but has remained well below average the last 3-years. Fewer cow elk and relatively low numbers of calves per cow has resulted in record low total recruitment. Low calf numbers = fewer total yearling bulls = low spike escapement and recruitment into adult classes = fewer branched bull permits. Given the calf numbers seen in late winter 2019, the 2019 harvest will likely again be low.

The Department collaborates with the U.S. Fish and Wildlife Service (USFWS) to estimate elk abundance in the Rattlesnake Hills sub-herd area using a sightability correction model developed for elk in Idaho (Unsworth et al. 1999). Starting in 2015, winter surveys switched from annual to alternate years. No funding was available for the scheduled January 2019 survey, so the next survey will be conducted in early 2020. During the last survey in January 2017, elk abundance was estimated to be 1,070 elk, which far exceeds the management objective of 350 elk (Figure 5). Bull:cow and calf:cow ratio estimates for the subherd are shown in Figures 6 and 7.

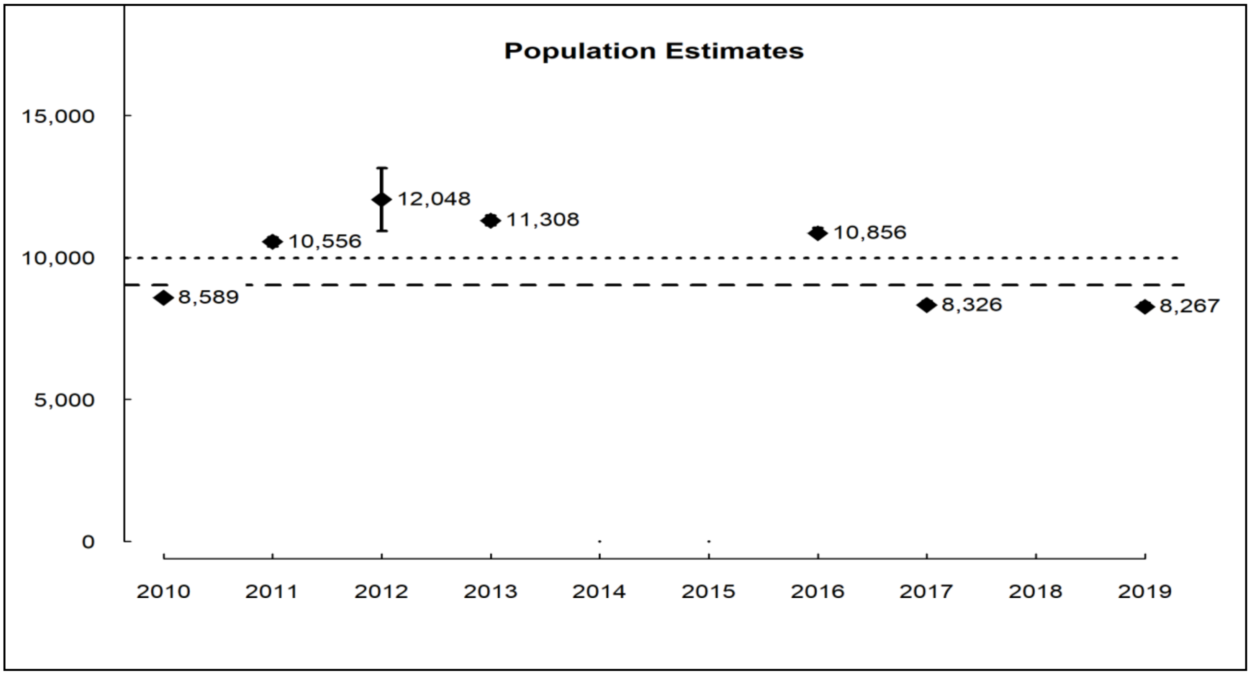

Figure 2. Sightability corrected estimates of total elk abundance with associated 95% confidence intervals in the Yakima elk herd area, spring 2010–2019. The dashed lines represent management objectives for total elk abundance (9,025-9,975 elk).

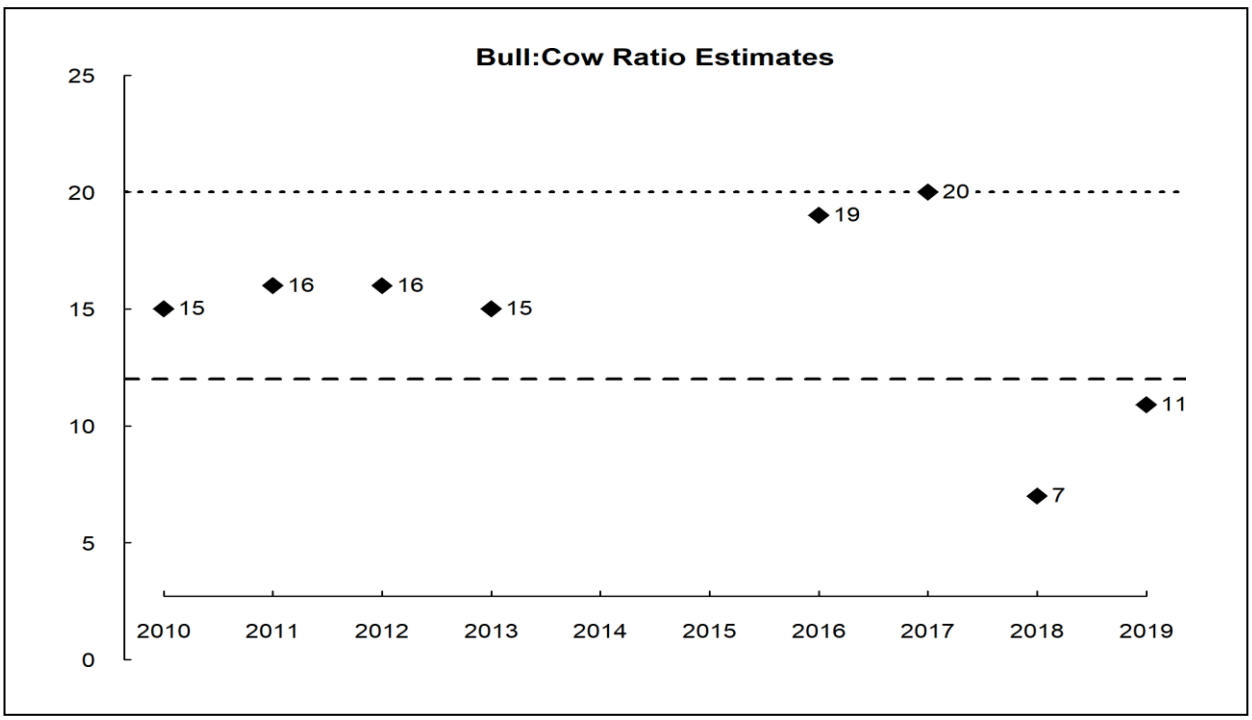

Figure 3. Estimates of post-hunt bull:cow ratios in the Yakima elk herd area, spring 2010–2019. The dashed lines represent the objective range of 12-20 bulls:100 cows. Estimates in 2018 are based on ground sampling and are not thought to accurately reflect the true population ratios due to low observability of bulls from the ground.

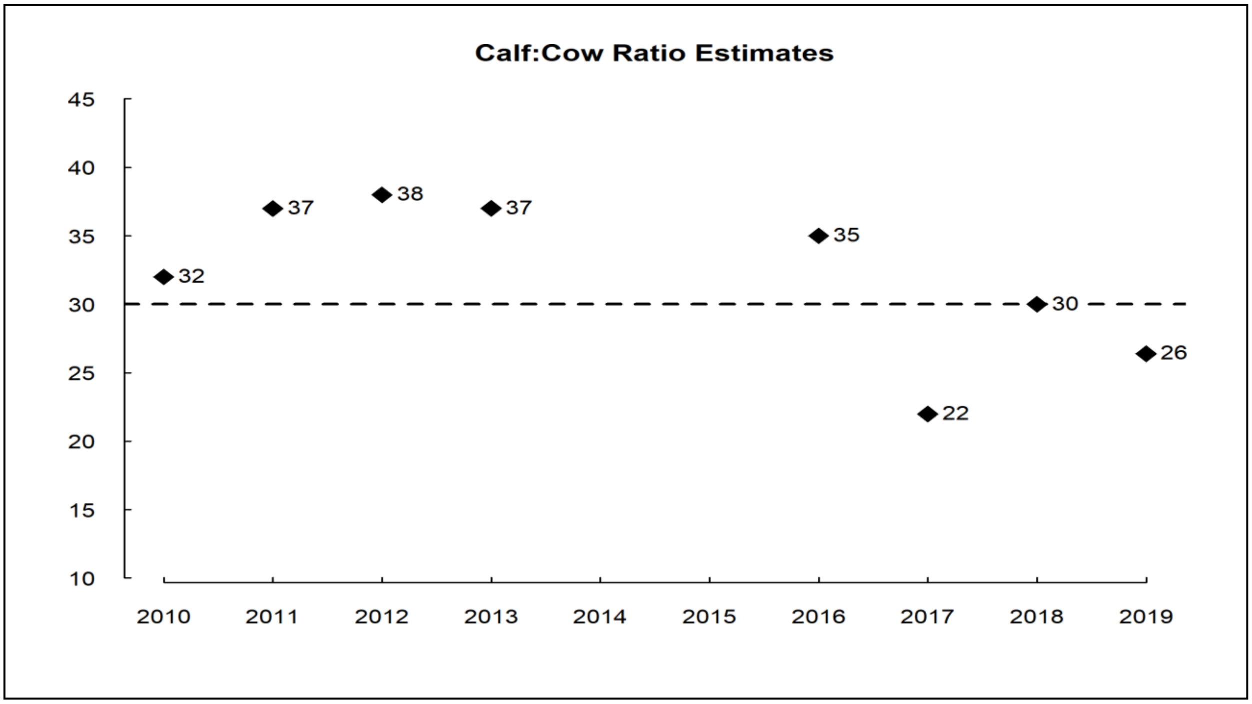

Figure 4. Estimates of post-hunt calf:cow ratios in the Yakima elk herd area, spring 2010–2019. The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth.

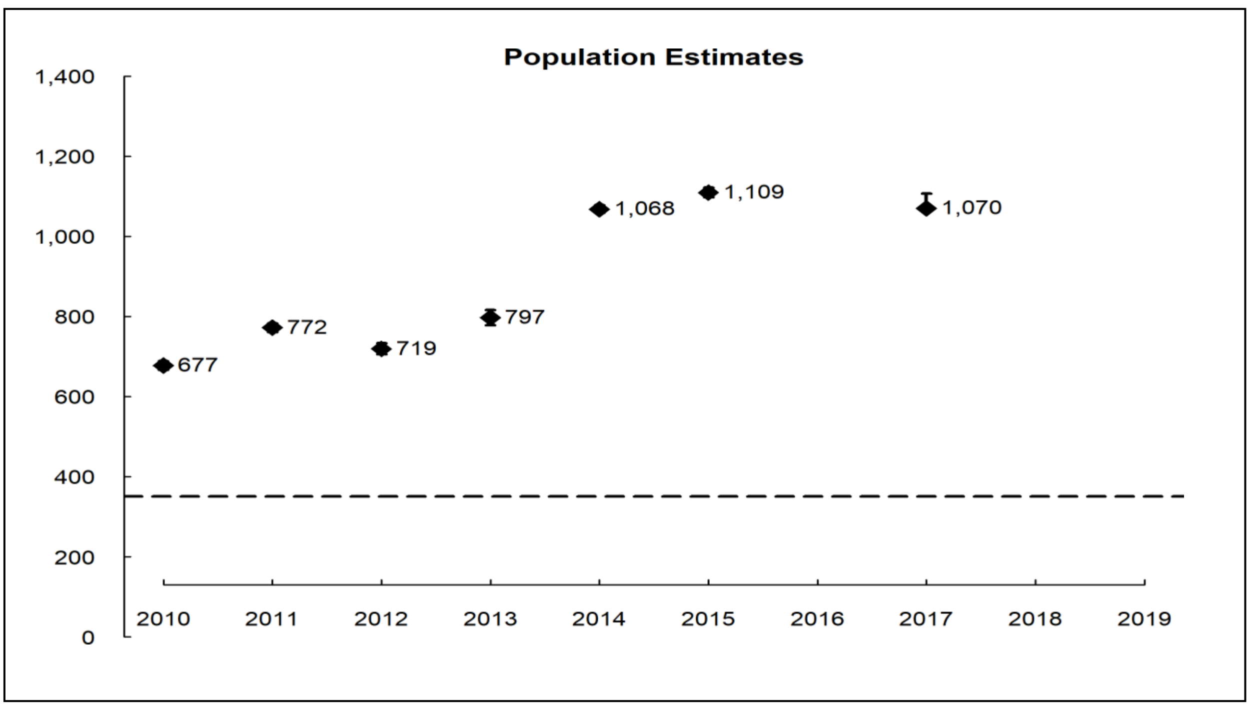

Figure 5. Sightability corrected estimates of total elk abundance with associated 95% confidence intervals in the Rattlesnake Hills sub-herd area, spring 2010–2019. The dashed line represents the management objective of ≤350 elk.

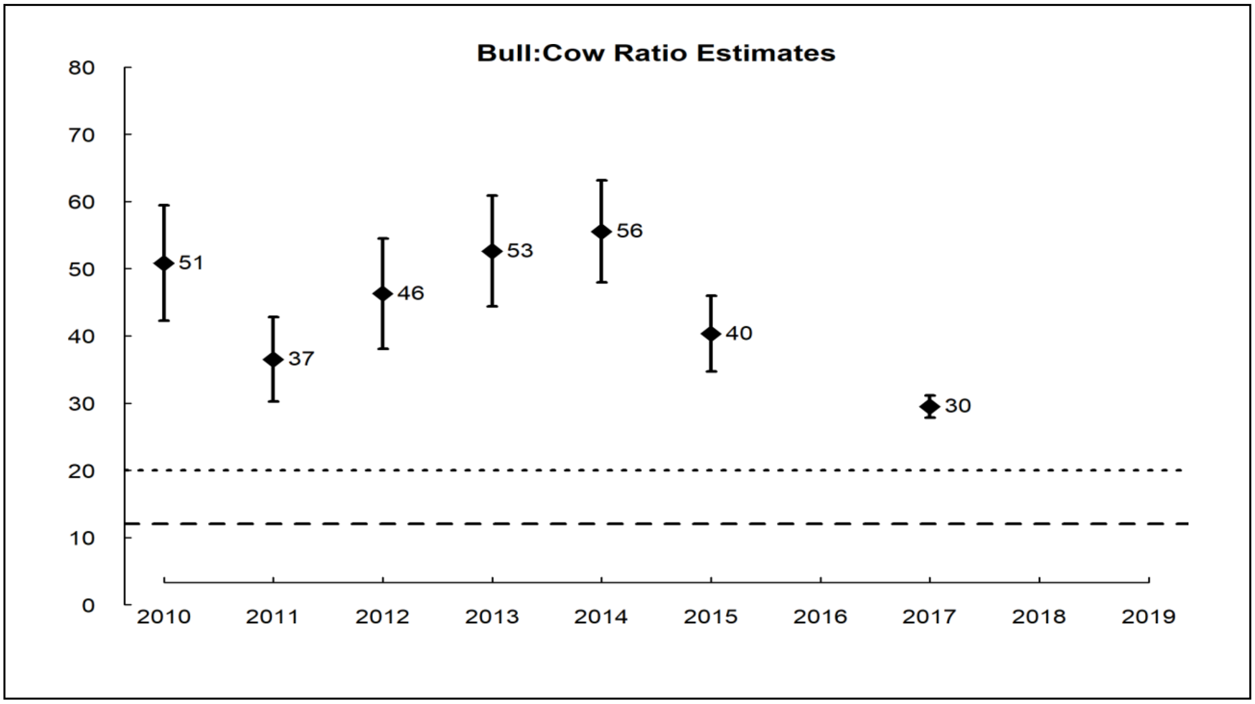

Figure 6. Estimates and associated 95% confidence intervals of post-hunt bull:cow ratios in the Rattlesnake Hills sub- herd area, spring 2010–2019. The dashed lines represent the objective range of 12-20 bulls:100 cows.

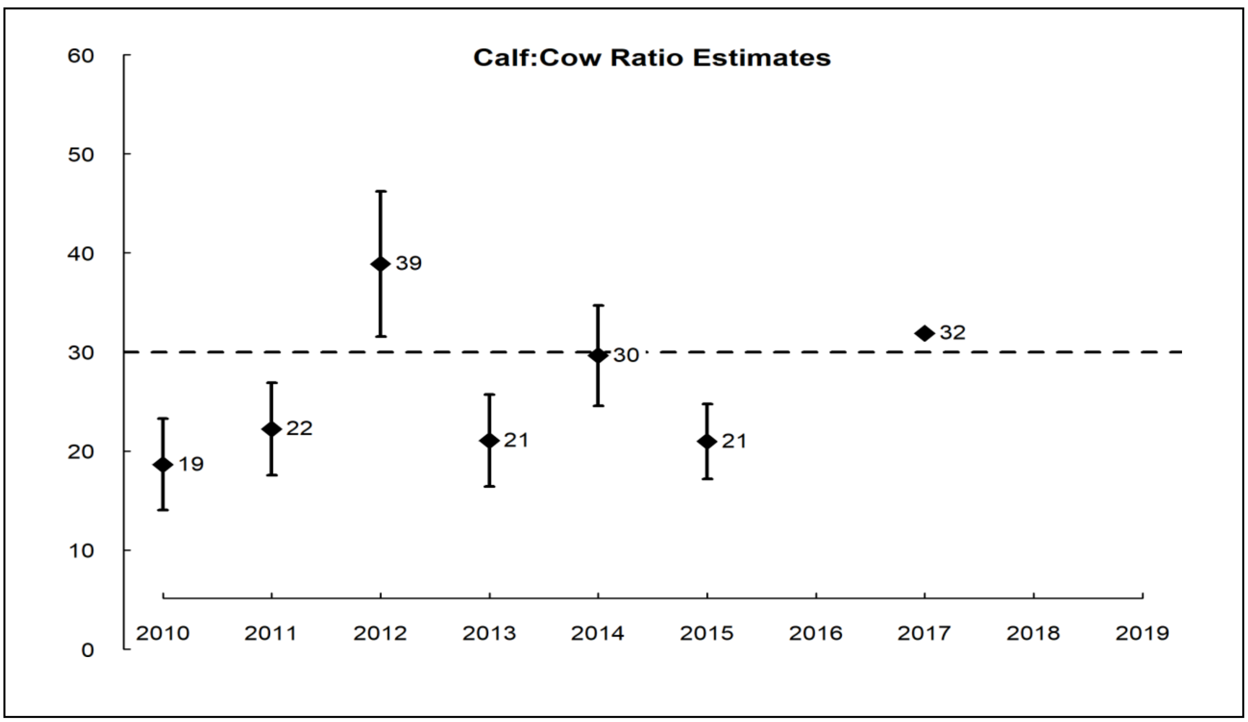

Figure 7. Estimates and associated 95% confidence intervals of post-hunt calf:cow ratios in the Rattlesnake Hills sub-herd area, spring 2010–2019. The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth.

Hunting Seasons and Recreational Harvest

The Department restricts most general season opportunities to harvest elk in most Yakima herd GMUs to spike bulls and offers opportunities to harvest branch-antlered bulls under special permits. The Department generally focuses most opportunities to harvest antlerless elk in areas adjacent to private land to help alleviate agricultural damage or where surplus antlerless elk exist.

Estimates of harvest during general seasons and total harvest have averaged 832 and 1,491 elk, respectively, 2009-2018. Both estimates have varied annually (Figure 8). Harvest does not include damage/kill permits or correction for any type of permit non-report. Proportions of antlered and antlerless elk harvest that occurred during general and permit seasons are shown in Figures 9 and 10. Trends in hunter numbers and kills per 100 days of effort are shown in Figures 11 and 12.

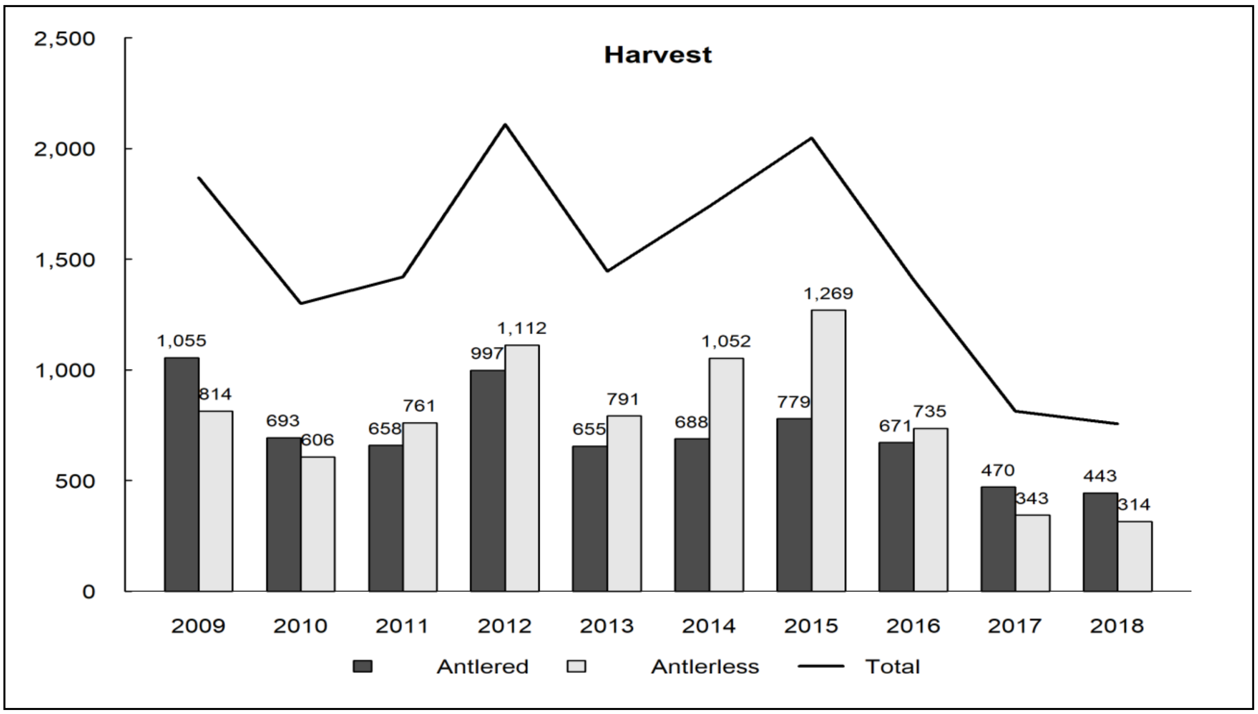

Figure 8. Estimated number of antlered and antlerless elk harvested in the Yakima elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department, 2009-2018. Estimates do not include elk harvested in association with damage permits (see Human Wildlife Interaction below). Estimates also do not include harvest that occurred during established Tribal seasons because that data is currently not available.

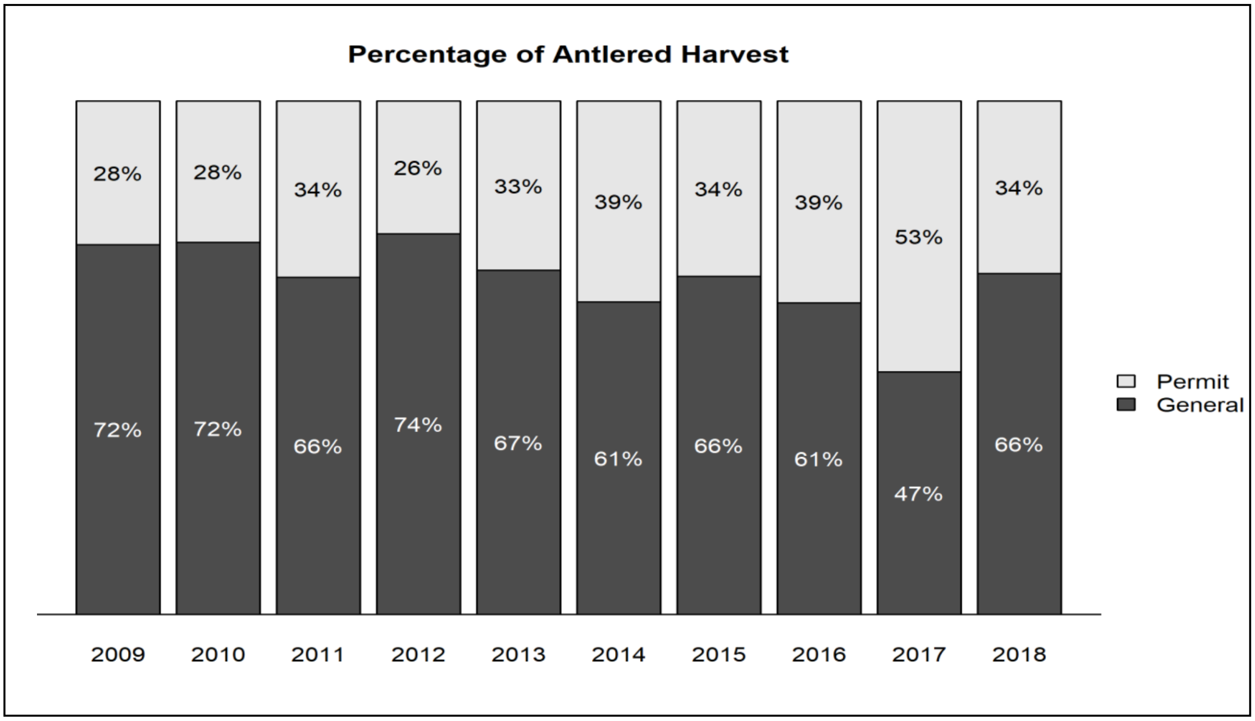

Figure 9. Estimated percentage of recreational antlered harvest in the Yakima elk herd area that occurred during general and permit seasons, 2009-2018.

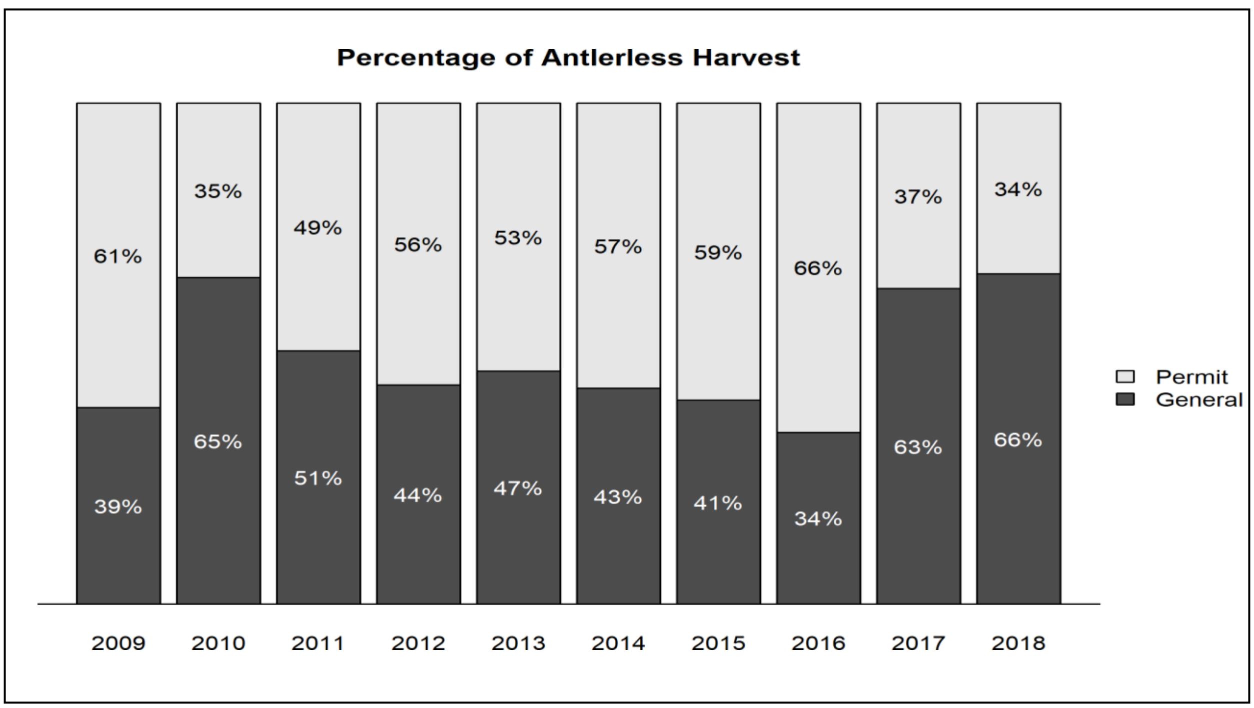

Figure 10. Estimated percentage of recreational antlerless harvest in the Yakima elk herd area that occurred during general and permit seasons, 2009-2018.

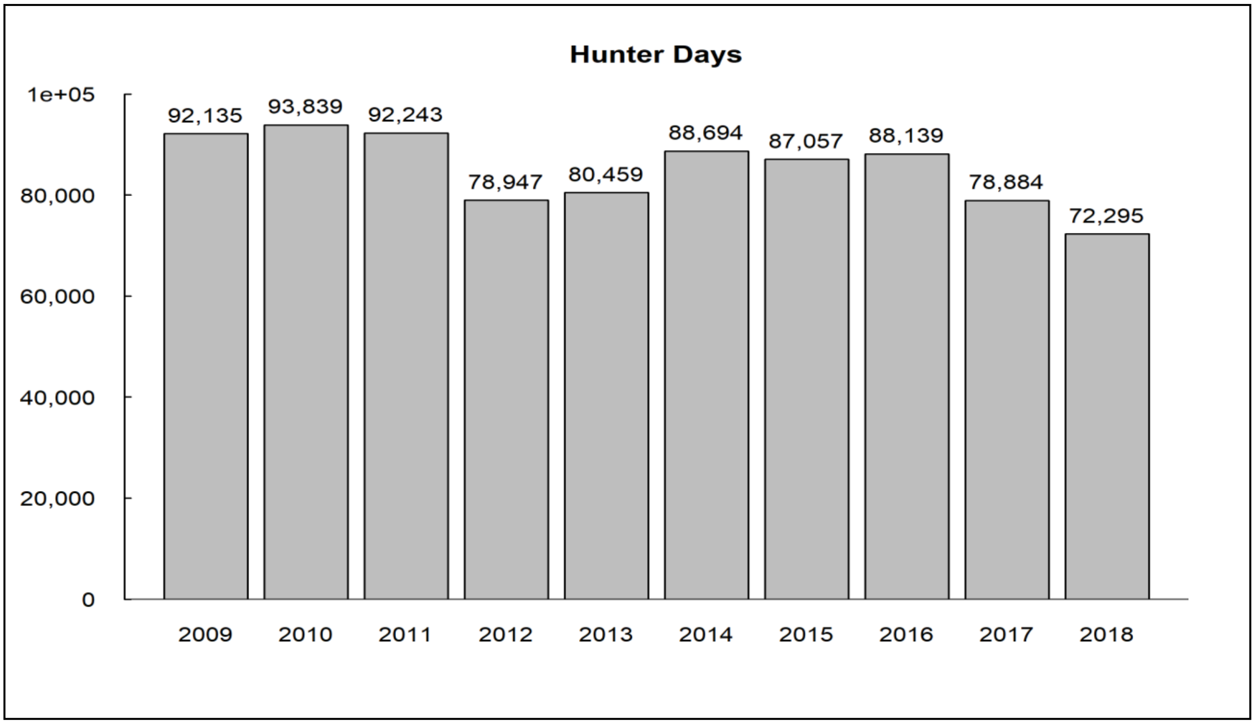

Figure 11. Estimated number of days hunters spent pursuing elk in the Yakima elk herd area during recreational seasons that provided general over-the-counter opportunities, 2009-2018.

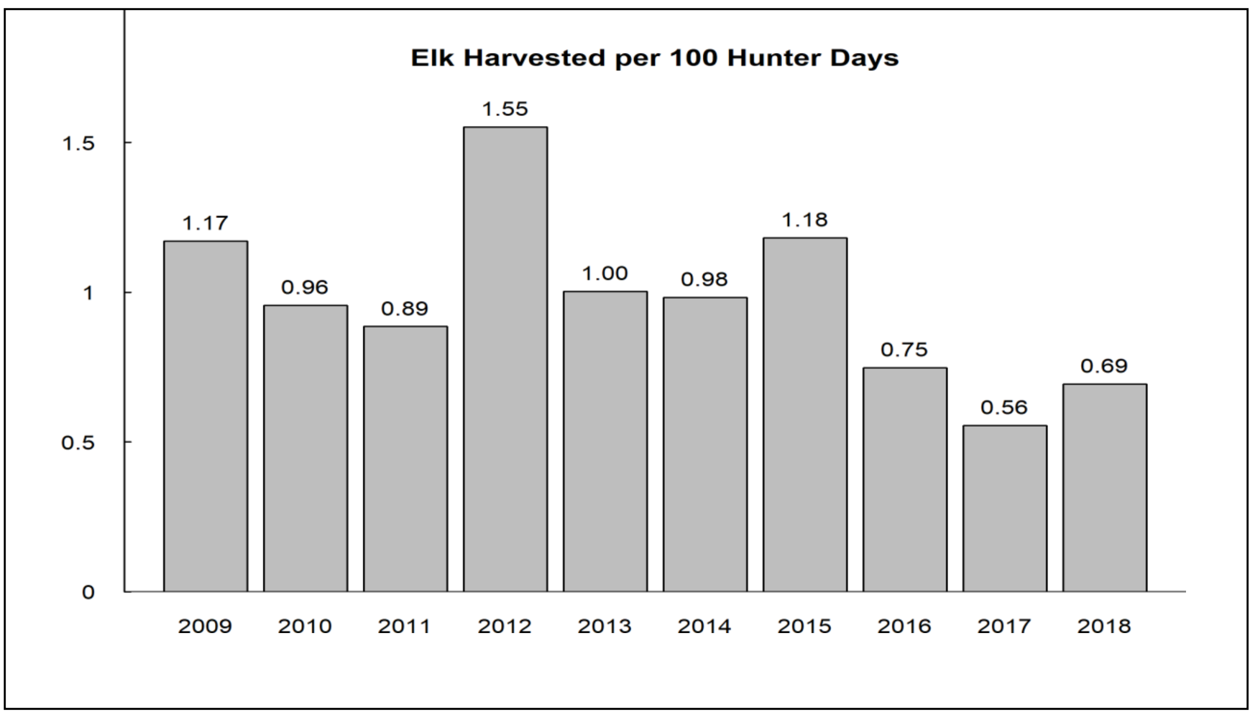

Figure 12. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the Yakima elk herd area during recreational seasons that provided general over-the-counter opportunities, 2009-2018.

Survival and Mortality

Common predators of elk that occur throughout the Yakima elk herd area include black bears and cougars, but black bears are more abundant in forested habitats. At the time of this writing, there were no documented wolf packs in the herd area (WDFW et al. 2019).

Substantial antlerless hunting opportunity occurred 2012-2016 in an attempt to reduce the population. However, after high harvest 2012-2015 (Figure 8), the population remained well above objective (Figure 2) as calf recruitment remained above average (Figure 4). The Yakima elk herd has never been historically prone to winter mortality. This is partially due to up to 70% of the herd being fed during normal and severe winters. That appears to have changed during the winters of 2015-2016 and 2016-2017. It is believed that surveys conducted in February 2016 failed to document a winter mortality event that occurred in March because elk carcasses were evident during a deer survey in April. However, the magnitude of the population decline was not documented until biologists conducted surveys in February 2017. The population decline was from higher than average winter mortality for cows and a low calf recruitment. Antlerless harvest has since been reduced, but overall calf recruitment still remains low.

The Department (S. McCorquodale, WDFW, unpublished data) monitored the survival of adult female elk and branch-antlered bulls in the Yakima elk herd area, 2003-2006, and estimated bull survival to be 0.63 (95% CI = 0.52–0.73). Estimated cow survival was 0.58 (95% CI = 0.39–0.75) in GMUs 336, 340, 342, and 346 in 2005 and 0.83 (95% CI = 0.73–0.90) during 2003, 2004, and 2006. Estimated cow survival across other portions of the herd area and across all study years was 0.88 (95% CI = 0.84–0.92). WDFW documented causes of mortality for 69 elk during that study and attributed 88% of all mortalities to human causes; one (<2%) mortality was attributed to predation (S. McCorquodale, WDFW, unpublished data). The impact of predation on calf recruitment was unknown because calves were not radio collared during this study.

Habitat

The USFS and Washington Department of Natural Resources (DNR) manage the majority of summer range within the Yakima elk herd area. Habitat quality for elk varies across these ownerships, depending on land management and underlying land cover types. A large portion of the herd migrates to wilderness areas, where the only factor impacting habitat is fire. In recent years, the USFS has opted to let some fires burn, which has increased long-term habitat quality. Outside wilderness, the USFS has emphasized reducing the potential for large fires by thinning and under burning. The impact of the thin/burn projects on elk habitat can vary but should increase forage availability long-term. The main concern is the high road-density in many areas and reduced security cover with reductions in canopy cover and screening vegetation. Elk may avoid large areas due to disturbance, even if forage quantity/quality increases. WDFW is now treating some of their lands with the goal of creating stands resilient to fire. Large tracts of open forest may result in elk distribution different than currently observed.

Human-Wildlife Interaction

In 2018-19, there were 238 damage/kill permits issued in the core Yakima herd area. Known harvest was 36, but the estimate might be low due to non-reporting. The Rattlesnake Hills sub-herd population remains above management objective. Crop damage is a constant concern amongst producers near the Arid Lands Ecology Reserve, which provides refuge for the majority of the sub-herd year-round. There are no elk feeding sites near the Rattlesnake Hills. Conflict Specialists work with landowners on preventative control efforts and lethal removal of elk to deter elk from visiting croplands that include wheat, orchards, and vineyards. From April 2018 thru March 2019, 249 damage prevention and 17 kill permits were issued to landowners in the Rattlesnake Hills sub-herd area, resulting in a minimum harvest of 54 elk. In addition to these permits, the use of non-lethal deterrents and public hunting have reduced conflict despite an increasing elk population over the past decade.

Management Concerns

The Yakima elk herd had been at or above objective for much of the last decade and has been very productive. Surplus of elk allowed for significant recreational opportunity, including antlerless harvest. Recreational harvest, drought, and severe winter weather in 2015-2016 reduced herd size and hunting opportunity. The herd has historically rebounded quickly after poor recruitment years but did not in 2017 or 2018. It will likely take some time to bring elk numbers back to objective. This will mean reduced antlerless opportunity in the interim. In 2018, all GMU's will still be open to general season archery hunting, but the seasons remain shortened to reduce harvest. Harvest was reduced in 2018 by this approach, but the population did not change and remained ~1,200 below objectives. Unless recruitment increases significantly, recovery will be prolonged under recent mortality levels.

There are often questions about the winter-feeding program and if there are ways to get elk to move from feed sites to natural winter range. WDFW owns or leases (from DNR) much of the available elk winter range. One of the management issues with elk feeding is human disturbance. Feed sites are closed to all access, but away from feed sites winter range is open to recreation throughout the winter. WDFW lands were originally obtained for elk and deer winter range, but these areas have become very popular for recreation. Elk seek security from human disturbance and would likely concentrate on closed areas even if they were not fed. Closing access to winter range can be controversial. For the foreseeable future, a large portion of the Yakima elk herd will be fed when winter dictates the need. Feeding is driven by needs to control elk distribution in winter; elk are not fed to prevent starvation.

The trend of managing lands for fire resiliency may lead to more open stands with little security for elk. This is expected to result in a change in elk distribution. When elk do enter high road density areas with minimal cover during hunting seasons, their vulnerability to harvest is high. Managing for a specific harvest to meet population objectives could become more difficult.

Management Conclusions

The Department had been meeting its management objective of maintaining a population with 12–20 bulls:100 cows in the post-hunt population and expects that to continue. However, the overall number of bulls recruited into the population has declined as a result of poor calf recruitment in 2017, 2018, and 2019 and an overall reduction in the number of cows in the population. Branched bull opportunity was reduced, but not enough to keep the bull ratio from falling below objectives.

As such, the Department may need to reduce opportunities to harvest bulls in the near future to maintain bull:cow ratios that are within objective, in addition to reducing antlerless harvest to prevent further declines in the overall population. Finally, the Rattlesnake Hills sub-herd remains above objective because hunting is not allowed on ALE or the adjacent federal Hanford Site, which limits the Department's ability to manage this sub-herd.

Literature Cited

Unsworth, J. W., F. A. Leban, E. O. Garton, D. J. Leptich, and P. Zager. 1999. Aerial Survey: User's Manual. Electronic Edition. Idaho Department of Fish and Game, Boise, Idaho, USA.

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

Washington Department of Fish and Wildlife. 2002. Yakima Elk Herd Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA.

Washington Department of Fish and Wildlife, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Washington Department of Fish and Wildlife, Wenatchee, WA, USA.

Mountain Goat

Mountain Goat Status and Trend Report

STATEWIDE

RICHARD B. HARRIS, Special Species Section Manager

Management Guidelines and Objectives

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 (except 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 has begun 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 was instituted in 2015, and it has increased the accuracy of our knowledge of female harvest, as well as provided valuable information on ages, disease status, and location of harvests.

Population Surveys

Surveys are conducted using a helicopter and generally occurred between July and late August. (Surveys in the Lake Chelan area had been conducted by Chelan County PUD biologists using winter-time boat-based surveys until 2019). 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.

Hunting Seasons and Recreational Harvest

Mountain goat hunting opportunity in Washington is limited by permit. Permit availability (and therefore hunter opportunity) decreased substantially beginning in the 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-nine (27 general permits, 1 raffle and 1 auction permit) were available in 10 goat management units in 2017; however, due to a fire that precluded access to one of the goat hunt units, 3 permits were returned to WDFW under the provisions of an emergency rule promulgated by the Washington Fish and Wildlife Commission. Thus, 24 mountain goat hunters were actually permitted in 2017. The 2017 mountain goat season provided 77 days of mountain goat hunting (September 15 to November 30; except that archery hunters, auction, and raffle permit hunters' seasons began September 1, and Conflict Reduction hunt permittees had shorter seasons). 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 19 goats. Winners of both the statewide auction hunts both harvested goats. Estimated success (including raffle and auction hunts) of hunters using their permits was thus 84%. Two of the four unsuccessful hunters had permits for the East Olympic Mountain unit; the other had a permit for the Avalanche Gorge area of Mt. Baker.

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.

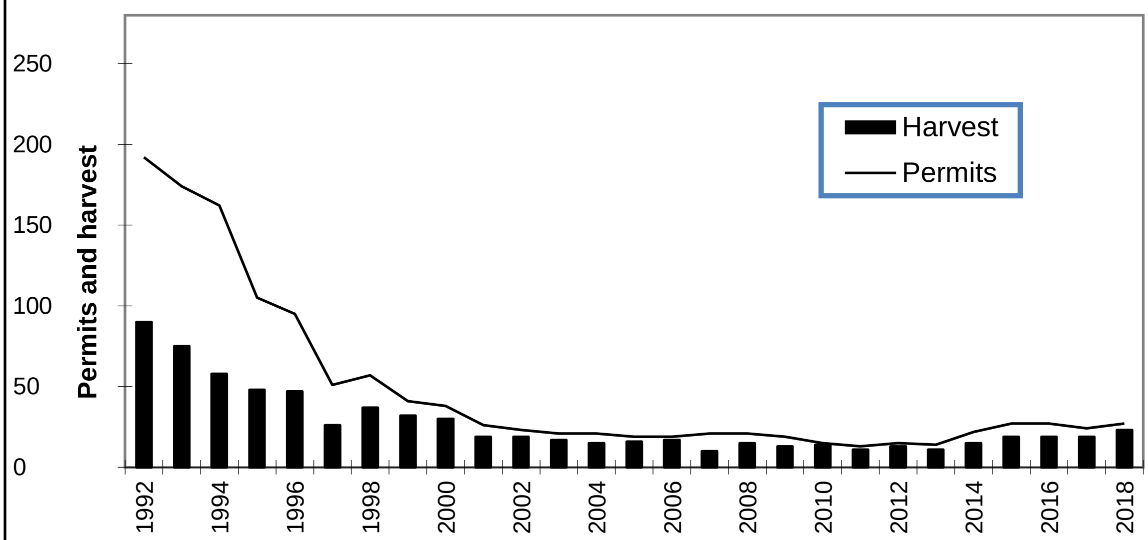

Figure 1. Special permits (line) and mountain goat harvests (vertical bars) in Washington, 1992-2018.

Survival and Mortality

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 2018, our best estimate for mountain goats within Washington numbered approximately 3,624 (lower and upper 90% confidence bounds of 3,045 and 4,301). Of these, about 1,043 live primarily within National Parks. As of 2018, we estimate that approximately 2,581 (90% confidence bounds 2,187 to 3,161) lived in the Cascade Mountains but not in 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 are mostly stable. Goat populations south of Darrington in the Boulder River Wilderness have increased to the level that allowed a modest hunting season which was initiated in 2015. Most dramatically, mountain goats around and north of Mt. Saint Helens have rebounded from their low numbers following the volcano eruption in 1980, likely responding to the ‘rebirth’ of new habitats in that area. There are suggestions that goats are recovering southeast of the Boulder River Wilderness, as well as on Glacier Peak.

Habitat

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.

Translocations

On June 18, 2018, after years of planning and extensive public review, the regional director of the U.S. National Park Service (NPS) signed a Record of Decision, authorizing the beginning of a plan to remove mountain goats (*Oreamnos americanus*) from the Olympic National Park (as well as adjacent portions of the Olympic National Forest). For the first few years of this work, the approved plan called for most mountain goats to be captured live and transported to staging areas on the Olympic Peninsula where they would formally become the responsibility of the Washington Department of Fish and Wildlife (WDFW). From these staging areas, mountain goats would then be transported to pre-selected staging areas in the North Cascades and brought to release locations where they would be returned to the wild.

Field implementation commenced in September 2018 and continued in July and August 2019. To date, 275 mountain goats have been translocated from the Olympic Peninsula to 12 areas within the North Cascades. Survival among adults has been lower than will ultimately be needed for sustainability, let alone population growth. However, we anticipated that abundance would decline before it would begin increasing; animals exploring new terrain are expected to suffer higher mortality rates than residents. At this early stage, it seems likely that some of the translocated goats will live out their lives without forming new or joining existing social groupings. We remain optimistic that many will find each other, begin producing offspring, and form the nucleus of new, or newly enlarged, breeding groups. As of November 5, 2019, data from GPS-transmitting collars suggested that at least 10 translocated billies had been in close proximity to translocated nannies for at least one day during the period November 1-3, 2019. Further details are available in two progress reports, both available on the WDFW website (Happe and Harris, 2018; Harris et al. 2019).

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.

Literature Cited

Happe, P. and R. Harris. 2018. Olympic National Park Mountain Goat Removal and Translocation to the North Cascades. Progress Report I. December 20, 2018. https://wdfw.wa.gov/publications/02036

Harris, R. P. Happe, and B. Murphie. 2019. Olympic National Park Mountain Goat Removal and Translocation to the North Cascades Progress Report II. November 5, 2019. https://wdfw.wa.gov/publications/

Johnson. R. L. 1983. Mountain goats and mountain sheep of Washington. Washington Department of Game Biological Bulletin No. 18. 196 p.

Rice, C. 2012. Status of mountain goats in Washington. Northern Wild Sheep and Goat Council 18: 64-70.

Rice, C.G., K. J. Jenkins, and W.Y. Chang. 2009. A sightability model for mountain goats. Journal of Wildlife Management 73(3):468–478.

Rice, C.G., and D. Gay. 2010. Mountain goat harvest in Washington State: effects on historic and contemporary populations. Northwest Naturalist 91: 40–57.

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

Mountain Goat Status and Trend Report: Region 2

Chelan County

DEVON COMSTOCK, Wildlife Biologist

Management Guidelines and Objectives

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 (excluding kids), with harvest of females below 1.2% of the estimated population excluding kids (WDFW 2014).

Population 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. Starting in 1982, the Chelan PUD began monitoring wildlife wintering in the Lake Chelan Basin (Pope & Cordell 2019). From 2006-2019 Chelan PUD conducted 12 winter wildlife surveys from a boat platform on Lake Chelan to inventory and monitor big game and other wildlife. Surveys have typically occurred from November to February annually. This is the only annually collected, long-term dataset for Chelan County mountain goats. During the 2018-2019 survey, there was an estimated minimum count of 63 mountain goats on both the north and south shores. Adult:kid ratios were estimated at 20 kids/100 adults on the north shore and 14 kids/100 adults on the south shore (Pope & Cordell 2019).

Year to year counts vary widely due to snow accumulation and weather conditions along the lake. In general, during heavy snow years, goats concentrate in higher densities along the lake to winter, providing a better opportunity to observe them. Due to the available terrain, rugged topography and tree cover, mountain goats can be incredibly difficult to survey from a boat. For this reason, the 2018-2022 Lake Chelan Wildlife Habitat Plan includes a provision allocating funds which allows WDFW personnel to plan and conduct annual species-specific aerial surveys to estimate abundance of mountain goats, bighorn sheep, and mule deer in the Lake Chelan Basin (Chelan PUD 2018).

Low snowfalls in recent years have created difficult conditions in which to survey. With adequate snowfall, goats move down to lower elevations where observation increases. As a comparison to ongoing boat-based survey methods, in February 2015 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 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. The aerial sightability survey returned an estimate of 91 goats

(90% CI = 74-108). In comparison, the maximum count from boat-based surveys conducted the next day totaled 15 goats (Pope and Cordell-Stein 2015). These results provide justification for our assumption the population is larger than the boat-based surveys indicate.

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, volunteer led survey efforts, using hiking routes, sought to determine presence of goats in portions of the Alpine Lakes Wilderness for which we had no data. Surveys from 2008-2015 averaged a high count of 65 mountain goats per year, which was comparable to previously compiled estimates of 50-75 animals (Rice 2012). This effort helped document the current mountain goat distribution and galvanized support for initiating aerial surveys to obtain a population estimate. In 2018, we successfully conducted aerial surveys of mountain goats in the Alpine Lakes Wilderness area that covered the Enchantments, Icicle Ridge, and the Wenatchee Mountains. Using a sightability-corrected survey, we estimated 71.4 goats with a 90% C.I. of 59.5-83.3. The kid to adult ratio was estimated at 22 kids:100 adults (90% C.I. 18-25).

Hunting Seasons and Recreational Harvest

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 two male goats were harvested. Only one permit was issued each year from 2002-2008, with permits increasing to two in 2009. In the past ten years, hunter success has been variable, with hunters in the North Lake Chelan unit enjoying an 80% success rate compared to approximately 60% success rate for the South Lake Chelan unit. Rugged terrain and remote wilderness with restricted access limits hunter success and makes finding adult males difficult. Over the past 10 years, in the North Lake Chelan unit 43% of harvested animals have been nannies.

Table 1A: Summary of Mountain Goat Harvest for North Lake Chelan, 2009-2018.

Year	Permits	Hunters	Harvest	Male	Female	Success	Days Hunted
2009	2	2	2	2	0	100	8
2010	2	2	2	2	0	100	5
2011	2	2	2	0	2	100	28
2012*	2	2	2	1	1	100	7
2013*	2	2	0	0	0	0	0
2014	2	1	1	1	0	100	5
2015	2	1	0	0	0	0	0
2016	2	2	2	1	1	100	27
2017	2	1	1	0	1	100	5
2018	2	2	2	1	1	100	15
Total	**20**	**17**	**14**	**8**	**6**	**80%**	**100**

Table 1B: Summary of Mountain Goat Harvest for South Lake Chelan, 2009-2018.

Year	Permits	Hunters	Harvest	Male	Female	Success	Days Hunted
2012	1	0	0	0	0	0	0
2013	1	1	1	1	0	100	6
2014	1	1	0	0	0	0	0
2015	1	1	1	1	0	100	6
2016	1	1	1	1	0	100	10
2017	1	1	0	0	0	0	13
2018	1	1	1	1	0	100	17
Total	**7**	**6**	**4**	**4**	**0**	**57%**	**52**

*For 2012 and 2013 additional harvest of 1 mountain goat from raffle/auction hunter harvest not included

A single permit will be issued for the South Lake Chelan unit for the fall 2019 season. The unit has been open for seven hunting seasons, opening in 2012. Special permit hunters have harvested four male goats in the six-years this unit has been open. In 2018, two additional billy goats were harvested by auction and raffle winners. The main factor in the lower success rate for this population is the difficulty accessing areas with goats.

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 they are currently closed to hunting. In 2018, aerial surveys conducted in the North Wenatchee Mountains Unit indicated that this population is still below the minimum threshold to initiate a permitted hunt.

Survival and Mortality

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 since 1982) appears, to be stable (Table 3). From 1982-2018, the kid:adult ratios were adequate for population growth, with the long-term average of 23.6 kids:100 adults. From 2015-2019, boat-based survey observations averaged 82 goats (range: 62-115), with 23 kids:100 adults (range: 16-29) (Pope & Cordell 2019). Goat counts for the Lake Chelan population have decreased over the last 5 years and production estimates have been variable. The 5-year kid:adult ratio for the South Shore Lake Chelan population is 17.6 kids:100 adults, while the North Shore is 28.6 kids:100 adults.

Table 2: Compiled minimum counts from ground and boat-based surveys in Chelan County 2009-2018.

Area	North Lake Chelan*	North Lake Chelan Adult:Kid*	South Lake Chelan*	South Lake Chelan Adult:Kid*	Stehekin	Chiwawa	North Wenatchee Mtns.	East Stevens Pass
2009-10	81	16	128	31		9	69	22
2010-11	78	27	94	53		8	38	10
2011-12	43	30	116	28	1		71	12
2012-13	74	32	103	26			56	
2013-14	45	23	50	10			78	
2014-15	48	30	45	29			117**	
2015-16	65	30	50	22				
2016-17	30	25	40	18				
2017-18	30	38	32	6			71	
2018-19	20	20	43	14				

* Data from Chelan PUD Winter Boat Surveys. **Increase due to volunteer survey effort.
Adult:Kid ratios calculated from total positively identified animals only.

Habitat

Fire suppression during the last 50 years has decreased habitat for mountain goats in Chelan County. Most mountain goat habitat is within wilderness areas 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). In 2015, the 65,000-acre Wolverine Fire burned across mountain goat habitat on South Lake Chelan. The fire burned over areas which were recovering from the 2007 Domke Lake fire, the 2004 Deep Harbor fire, and the 2014 Duncan fire.

Research

In 2002, a statewide mountain goat research project was initiated to determine habitat use, seasonal range, population status, methods of survey, and population limiting factors. 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. Permit numbers for the South Lake Chelan unit take into account the potential harvest of goats from Region 4. Three (3) goats were collared on Gamma Ridge in the fall of 2006 and traveled into the Chiwawa region of Chelan County, highlighting movement and interchange between populations.

Management Conclusions

Most mountain goat populations in Chelan County are below historic levels and 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 likely stable in both the north and south shore populations, however annual counts have recently been declining. Resources are being redirected to establish regular helicopter surveys near Lake Chelan to produce a sightability-corrected abundance estimate (Rice et al. 2009). Additional emphasis should be placed on new surveys in other sections 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. Given the large fire events in the past ten years in the Lake Chelan area and the number of recurring fires, it is important to understand how mountain goats utilize landscapes post-fire. There continues to be gaps in our understanding of the summer range of goats associated with the South Shore Lake Chelan population and their potential interchange with goat populations of the Mount-Baker Snoqualmie National Forest. As resources allow, studies of the seasonal range of the Lake Chelan population and improved abundance estimates should be prioritized.

Literature Cited

Pope, V. R. and Cordell-Stine, K. A. 2015. Lake Chelan Annual Winter Wildlife Survey Report: Winter of 2014-2015. Chelan Public Utility District, Wenatchee WA.

Pope, V. R. and Cordell, K. A. 2019. Lake Chelan Annual Winter Wildlife Survey Report: Winter of 2018-2019. Chelan Public Utility District, Wenatchee WA.

Public Utility District No. 1 of Chelan County. 2018. Wildlife Habitat Plan 2018-2022. License Article 406. 32 pp.

Rice, C.G., K. J. Jenkins, and W.Y. Chang. 2009. A sightability model for mountain goats. Journal of Wildlife Management 73(3):468–478.

Rice, C.G. 2012. Status of Mountain Goats in Washington. 18th Biennial Symposium of the Northern Wild Sheep and Goat Council 18: 64-70.

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

Mountain Goat Status and Trend Report: Region 2

Methow

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Management Guidelines and Objectives

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.

Population Surveys

As resources allow, the Department conducts 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. Annual surveys were consistent through 2007 however; limited resources have precluded surveys for most years thereafter. Poor survey conditions and timing produced suboptimal surveys in 2009 and 2013. Surveys occurred in 2016 with good conditions and timing: however, only 38 goats were observed (table 2).

Hunting Seasons and Recreational Harvest

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). 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 subsequent surveys yielding low numbers of animals, harvest has been suspended since 2014.

Survival and Mortality

This unit had been monitored closely from 2000-2007 with a stable population being observed. Since 2009, surveys suggest a decline in the population size. 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.

In September 2018 and August 2019, an effort to remove mountain goats from the Olympic Mountains and release them into other populations was implemented. The Methow Unit benefitted with the release of 35 goats near Tower Mountain (19 adult females, 6 adult males, 3 yearling females, 4 female kids, 3 male kids). As of early November 2019, 23 of these goats remain alive. The goal of this augmentation is to boost genetic diversity and improve overall population numbers and connectivity between goat bands in the Methow Unit.

Habitat

Goats in the Okanogan District experienced a below average snowpack during the 2018-2019 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. 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. We are concerned that fire exclusion may have reduced the quantity or quality of summer forage resources for goats in alpine terrain.

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 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. After the translocated animals have settled into new home ranges the need to redraw unit boundaries to better reflect goat distribution will be explored.

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	--	--	--	--	--

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	--	--	--	--	--
2016	10	2	26	38	*38
2017	--	--	--	--	--
2018	--	--	--	--	--

*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.

Mountain Goat Status and Trend Report: Region 3

Blazed Ridge, Bumping River, Naches Pass

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Management Guidelines and Objectives

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, and 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 older than 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.

Population Surveys

Tables 1-3 show annual survey results for mountain goat units in Region 3.

Hunting Seasons and Recreational Harvest

Mountain goat seasons are open only to hunters drawing a special permit or winning a raffle or auction. In 2018, there were originally 7 permits distributed among 2 units (Tables 1-3) in Region 3. The Naches Pass Unit was closed to access by the USFS due to a fire in 2017 and those permits were rolled over into 2018. Six of 7 hunters had goats checked by WDFW staff, with 3 billies and 3 nannies. This was the first year of the new mandatory sex identification test for goat hunters. The goal of the test was not achieved in this first year, as the previous 5-year average was 75% billies harvested.

Survival and Mortality

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 mountain goat populations in the Region likely 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 have likely increased, although there is no obvious trend in the last 6 years. The trend for Kachess Ridge is unknown, as no surveys have been conducted there since 2005.

Habitat

The majority of goats in the Bumping and Naches Pass areas spend summers in wilderness areas where short- term habitat is mostly influenced by weather cycles. A 2017 fire near Naches Pass temporarily reduced forage and cover. Long-term, summer habitat should improve, but the lack of cover may impact winter survival. Insect outbreaks in the last 10 years have also killed trees, which may improve forage. There have been several small fires due to lightning that the USFS is now inclined to let burn in wilderness. 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 in both units in the last 10-15 years may have impacted winter habitat. The north portion of the Blazed Ridge unit has been 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 had been generally increasing since harvest has been restricted to 4%. Hunters had generally been good at selecting billies until 2018. The slight decline in 2018 may have been due to drought and more severe winters in 2015-2016 and 2016-2017 or simply missing goats on surveys. The Blazed Ridge Unit is an example of how surveys can vary. Population estimates for Blazed Ridge have ranged between 46 and 104 goats the last 5 survey years. The large swings are larger than would be expected from survey-related sampling variation alone and may reflect movements in and out of the survey area.

Current 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 been arbitrarily drawn in the past, using little knowledge of population structure or movements. In recent years, this led to a conservative harvest. Following decades of overharvest, it was prudent to be conservative. Now that populations are recovering, it may soon be time to revisit objectives for populations and harvest. For units south of I-90, there were an estimated 440 total goats and 306 adults in 2015. A 4% take quota would have allowed 12 permits instead of 6 had the population been viewed at a larger scale. The estimate of 440 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 park boundary. That said, local overharvest can occur if harvest, particularly of nannies, is concentrated within a small area, even if it is numerically sustainable on a larger geographic scale.

North of I-90, the Kachess Unit population is 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 may be over 100 adult goats between these highways. If surveyed, there may be justification for additional hunting opportunity.

Goal #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.

Literature Cited

Rice, C.G., K. J. Jenkins, and W.Y. Chang. 2009. A sightability model for mountain goats. Journal of Wildlife Management 73(3):468–478.

Table 1. Harvest and Surveys for Bumping River (Mountain goat Unit 3-7) 2007 to present.

Harvest Information				Survey Data (for 2009 and later, figures represent points estimates from sightability-corrected model; Rice et al. 2009)			
Year	**Permits**	**Hunters**	**Harvest (females in parentheses)**	**Kids**	**Older than Kids**	**Total**	**K:100**
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 (0)	43	108	151	39
2014	2	2	1 (0)	No	Survey		
2015	3	3	3 (1)	44	101	147 [a]	44
2016	3	3	3 (0)	No	Survey		
2017	3	3	3 (1)	No	Survey		
2018	3	3	3 (1)	33	94	127	36

* Includes auction/raffle

[a] Includes unclassified/yearling

Table 2. Harvest and surveys for Naches/Corral Pass (Mountain goat Unit 3-6 and 4-38) 2007 to Present.

Harvest Information				Survey Data (for 2009 and later, figures represent points estimates from sightability-corrected model; Rice et al. 2009)			
Year	Permits	Hunters	Harvest (females in parentheses)	Kids	Older than Kids	Total	K:100
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 (0)	45	104	169[a]	43
2014	2	2	1 (0)		No	Survey	
2015	3	3	3 (0)	61	125	193 [a]	49
2016	3	4*	4 (3)*		No	Survey	
2017	3	0	0		No	Survey	
2018	4	3	3 (2)	17	115	132	15

* Includes auction/raffle/tribal

[a] Includes unclassified

Table 3. Harvest and surveys for Blazed Ridge (Mountain goat Unit 3-10) 2007 to Present.

Harvest Information				Survey Data (for 2009 and later, figures represent points estimates from sightability-corrected model; Rice et al. 2009)			
Year	Permits	Hunters	Harvest (females in parentheses)	Kids	Older than Kids	Total	K:100
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 (0)	14	53	67	27
2014	1	1	1 (0)	No	Survey		
2015	0	n/a	n/a	19	80	102	24
2016	0	0	0	No	Survey		
2017	0	1*	1	22	78	100	28

* Includes auction/raffle

[a] Probable double count of ~15 animals

Mountain Goat Status and Trend Report: Region 4

Mt. Baker and Boulder River North Areas

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Management Guidelines and Objectives

The management objective for mountain goat units in 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 listed in the WDFW 2015–2021 Game Management Plan (2014). Guidelines restrict 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%. To accomplish this more directly, WDFW restricts permitting if the number of females harvested exceeds 1.2% of the estimated number of adult goats in the harvest unit, averaged over a 3-year period. If guidelines are exceeded, harvest strategies may need to be revised to prevent population declines.

After being closed for many years, the Mt. Baker area was reopened on a limited basis for mountain goat hunting in 2007. Subsequent surveys in this area suggest an increasing population (previous Status and Trend reports), which permitted gradual increase in hunting opportunity (Table 1).

Mountain goat surveys in 2012 within the Boulder River Wilderness Area also suggested greater numbers than were previously seen in the early 2000s. The number of mountain goats in this area met the minimum requirements to establish a hunting season set in the 2015-21 Game Management Plan (WDFW 2014). Subsequently, a hunting season was initiated in the Boulder River North Goat Hunt Unit beginning in 2015, with a single permit allocated annually to a State hunter.

Population Surveys

Population surveys were not conducted by WDFW for several years in the Boulder River Wilderness before 2012, because of low population numbers and the fact that all units within the Darrington Ranger District of the Mount Baker Snoqualmie National Forest were closed to hunting in 1995. WDFW reinitiated surveys in this area in 2012 (Figure 1).

Beginning in 2014, WDFW adopted a system of biennial surveys. Additionally, WDFW began translocating mountain goats from Olympic National Park to the North Cascades beginning in 2018, thus WDFW did not survey mountain goats at Boulder River (Figure 1) or Mt. Baker (Figure 2) in 2015 or from 2017–2019. The Stillaguamish and Sauk-Suiattle Tribes surveyed the Boulder River Unit in 2015, 2017, and 2018. The Swinomish and Upper Skagit Tribes surveyed the Mt. Baker area (Black Buttes, Chowder Ridge, Coleman Pinnacle, Heliotrope, Lava Divide North, Lava Divide South, Loomis Mtn.) in 2019, generating a total estimate of 346 goats (90% CI = 329–362; Figure 2). Due to the inconsistent classification of adults and yearlings in previous surveys, individual goats were classified as either an adult or a kid beginning in 2019.

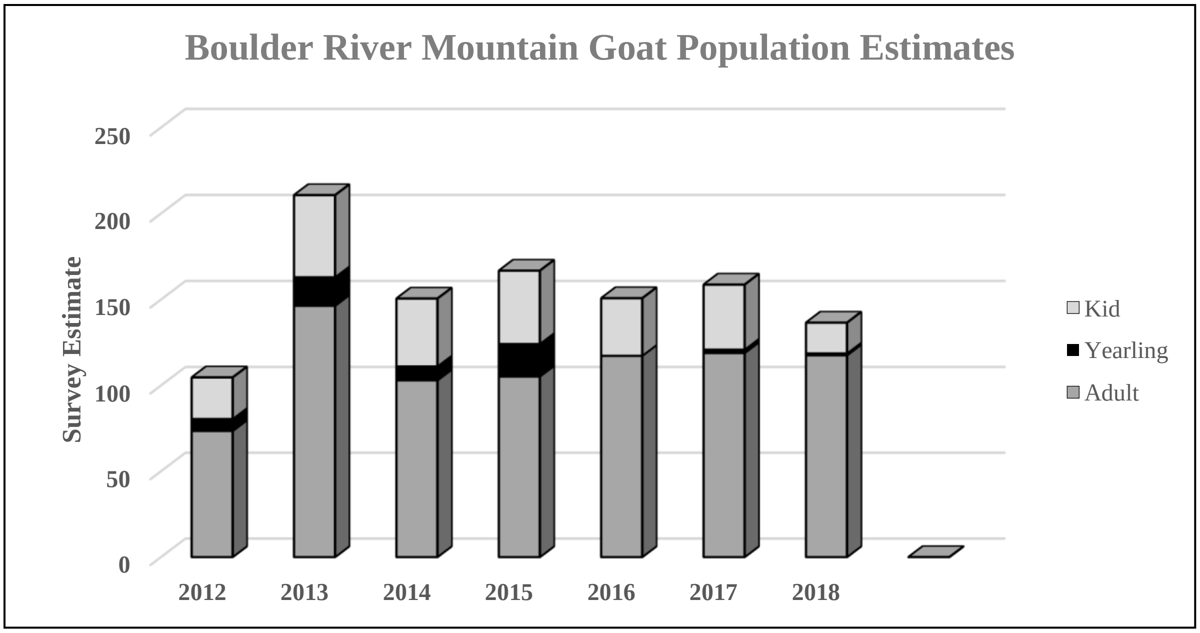

Figure 1. Results from mountain goat aerial surveys in the Boulder River North Hunt Unit from 2012-2019. No survey was conducted in 2019 due to mountain goat translocation work. Estimates are calculated based on numbers derived from the Three Fingers and Whitehorse survey blocks only.

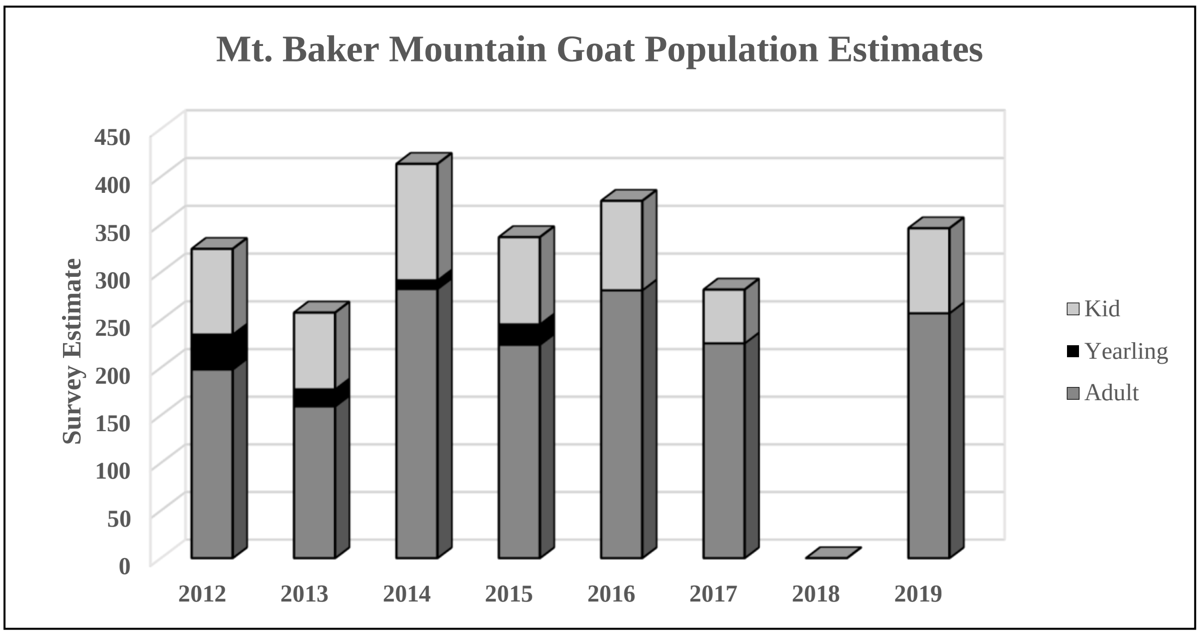

Figure 2. Population estimates from WDFW and Tribal mountain goat aerial surveys in the Mt. Baker Area from 2012-2019. No survey was conducted in 2018. Beginning in 2019, goats were classified as either an adult or a kid. Estimates are calculated based on numbers derived from the Black Buttes, Chowder Ridge, Coleman Pinnacle, Heliotrope, Lava Divide, and Sholes Glacier survey blocks only.

Table 1. Permit numbers, hunters, harvest, hunter success rates, and total days hunted, Mt. Baker and Boulder River North mountain goat hunt units, 2009-2018.

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	N/A
	2013	1	1	1	100	0
	2014	2	2	2	100	5
	2015	1	1	1	100	23
	2016	1	1	0	0	3
	2017	1	1	1	100	1
	2018	1	1	1	100	2
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
	2015	2	2	2	100	33
	2016	2	2	1	50	3
	2017	2	2	2	100	6
	2018	2	1	1	100	9
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
	2015	3	4	3	75	56
	2016	3	3	2	50	15
	2017	3	3	2	67	18
	2018	3	2	2	67	7
Boulder River North	2015	1	1	1	100	8
	2016	1	1	1	100	2
	2017	1	1	1	100	2
	2018	1	1	1	100	17

Survival and Mortality

Historically, the majority of information regarding goat numbers and distribution was derived from harvest report cards and questionnaires returned by permitted hunters. Additionally, 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 of 13 goats harvested per season. From 1986-95, harvest totaled 26 animals, with an average of six goats harvested per season. By 1996, all the Mt. Baker GMUs were closed to hunting due to declines in harvest and goats reported by permit hunters. In 2007, Mount Baker units 4-3 (Chowder Ridge) and 4-7 (Avalanche Gorge) were reopened with one permit issued per unit. The Mt. Baker area now includes units 4-3, 4-7, and 4-4 (Lincoln Peak), with a conservative approach limiting the annual allocation of permits in 2019 to six permits. Within the Boulder River North hunting unit, the population appears stable, with the estimated population (not including kids) exceeding 100 animals in all years post 2012 (Figure 1).

Habitat

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 will continue, or if the population is reaching the capacity of the area to maintain goats. The conservative hunting season, reestablished in 2007, appears to have 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 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 in recreational uses, including hiking, backcountry skiing, and snowmobiling. Discussions on goat management between WDFW and the Tribes are ongoing and remain a high priority.

The Boulder River North unit lies within the Boulder River Wilderness managed by the Darrington District of the Mount Baker/Snoqualmie National Forest. This area is seeing a population rebound similar to the increases seen on in the Mount Baker unit, suggesting that habitat quality in this area of the North Cascades is sufficient for mountain goats. However, we are concerned that fire exclusion may have reduced the quantity or quality of summer forage resources for goats in alpine terrain.

Literature Cited

Rice, C.G., K.J. Jenkins, and W. Chang 2009. A sightability model for mountain goats. Journal of Wildlife Management 73(3): 468–478.

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

Mountain Goat Status and Trend Report: Region 5

Goat Rocks, Smith Creek, Mt. St. Helens

STEFANIE BERGH, Wildlife Biologist

Introduction

Region 5 of the Washington Department of Fish and Wildlife (WDFW) contains multiple areas inhabited by mountain goats. Three mountain goat population management units have been monitored aerially in recent years; Smith Creek (Goat Unit 5-3), Goat Rocks/Tieton River (Goat Unit 5-4/5-5/3-9), and the Mt. St. Helens National Volcanic Monument (Goat Units 5-6 and 5-7). 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). For several years, a cooperative ground-based survey for mountain goats has been conducted in the Mt. St. Helens National Volcanic Monument and the first aerial survey was completed in 2017. Several other areas within Region 5 support mountain goats including the Dark Divide Roadless Area, Mt. Adams Wilderness, and the Tatoosh Mountains. Individual and small groups of mountain goats are reported throughout the southern Cascades region.

Management Guidelines and Objectives

WDFW's mountain goat management objectives are to manage mountain goats and their habitat to maintain or expand current population levels. In addition, mountain goats are to be managed for recreational, educational, and aesthetic purposes. Recreational management is to be consistent with a stable or increasing population.

Population Surveys

In 2019, the Goat Rocks/Tieton River Unit was aerially surveyed, yielding 228 animals observed (Table 1) and a sightability-corrected population estimate of 239 (90% confidence interval 226-253; Table 2). The sightability-corrected population of adult mountain goats in that unit was estimated at 171 (90% confidence interval: 162-181). The Smith Creek Unit was most recently surveyed from the air in 2017, yielding a sightability corrected estimate of 14 goats (90% confidence interval: 9-18; Table 2). In 2017, the first ever aerial survey of the Mt. St. Helens and Mt. Margaret Backcountry was conducted. A total of 223 goats were observed during the flight, which resulted in a sightability corrected estimate of 246 goats (90% confidence interval: 232-260; Table 2). The sightability corrected population of adult mountain goats in that unit was estimated at 188 (90% confidence interval: 178-199). All aerial surveys were conducted using the sightability method developed by WDFW (Rice et al. 2009).

Table 1: Raw Survey Data from Mountain Goat Flights, Region 5 (2005-2019).

Goat Unit	***Year***	***Adult***	***Kid***	***Unknown***	***Total***	***Kid:Adult***
Goat Rocks/Tieton River	2019	162	66	0	228	41:100
	2017	204	40	0	244	20:100
	2015	224	86	0	310	38:100
	2013	236	72	0	308	30:100
	2012	168	33	0	231	23:100
	2011	222	31	0	253	15:100
	2010	195	36	0	231	20:100
	2009	203	73	0	276	43:100
	2008	201	60	7	268	34:100
	2006	217	71	0	290	35:100
	2005	235	66	0	303	35:100
Smith Creek	2017	10	2	0	12	22:100
	2012	36	14	0	50	44:100
	2010	34	8	0	42	29:100
	2008	11	4	2	17	44:100
	2007	28	6	0	34	21:100
	2006	22	5	0	27	31:100
	2005	21	11	0	32	73:100
Mt. St. Helens/Mt. Margaret	2017	169	54	0	223	32:100

Table 2: Sightability Corrected Mountain Goat Survey Results – Region 5 (2005-2019).

Goat Unit	***Year***	***Population Estimate (90% CI)***
Goat Rocks/Tieton River	2019	239 (226-253)
	2017	254 (243-264)
	2015	325 (309-341)
	2013	232 (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	2017	14 (9-18)
	2012	64 (48-79)
	2010	41 (33-49)
	2008	32 (No CI)
Mt. St. Helens/Mt. Margaret	2017	246 (232-260)

Mountain goats were formally surveyed on Mt. St. Helens and the associated Mt. Margaret Backcountry in August of 2014 2015, 2016, 2017, and 2018. The ground-based effort involved simultaneous survey and documentation of all goat groups by multiple teams of observers at pre-arranged stations. The 2014 and 2015 surveys of Mt. St. Helens and in the Mt. Margaret, Backcountry yielded a minimum goat population of 63 and 150, respectively. In 2016, despite fog and low clouds impacting visibility, the survey yielded a minimum goat population of 151. In 2017, the survey was conducted the day before the aerial survey and a minimum of 162 mountain goats were counted. In 2018, the minimum goat population counted during the survey was 169. The project is a cooperative effort among WDFW, the U.S. Forest Service, the Cowlitz Tribe of Indians, and volunteers associated with the Mt. St. Helens Institute. Additional surveys are planned for the Mt. St. Helens area in the future as methodology and logistics are refined. A summary of aerial and ground surveys of Region 5 mountain goats over the past 10 years indicates a stable or potentially slightly declining population in the Goat Rocks, an increasing population in the Mt. St. Helens area, and possible decline in the Smith Creek area (Figure 1).

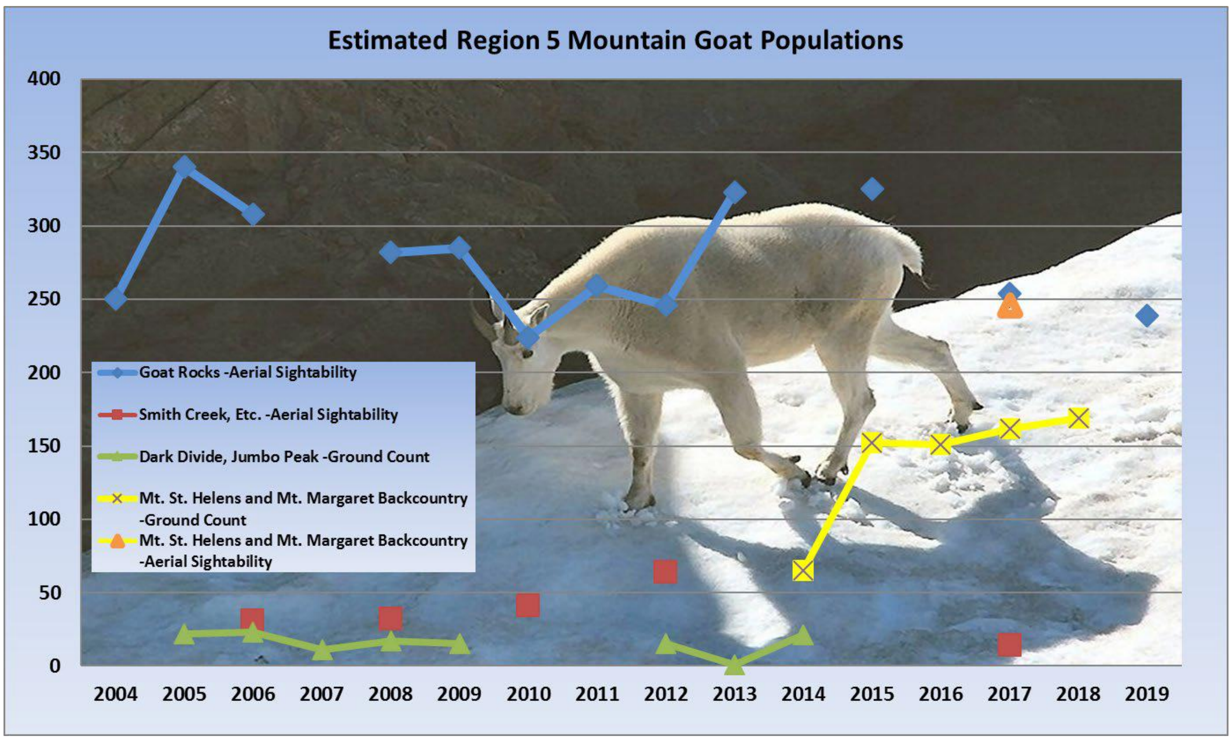

Figure 1. Estimated Region 5 Mountain Goat Populations

No additional mountain goat areas in Region 5 were surveyed during 2019 due to a lack of funding and because hunting permits are not currently offered for these smaller populations. Unsurveyed areas populated with mountain goats in Region 5 include the Tatoosh Mountains, Dark Divide, and areas between Indian Heaven Wilderness and Mt. Adams. Finally, individual and small groups of mountain goats are commonly observed throughout the southern Cascades in Region 5 and are also not surveyed.

Sightability corrected aerial surveys conducted over the past several years suggest stability in the Goat Rocks population and a possible decline in the Smith Creek goat population. Aerial surveys conducted in the mid-2000s by WDFW indicate that mountain goat populations in the Tatoosh

Unit have declined. The back-to-background and aerial surveys of the Mt. St. Helens population in 2017 indicated that the ground survey is greatly underestimating the total population. The ground survey provided critical information on an increasing goat population as well its distribution. These efforts provided impetus and direction for the aerial survey, which is expected to be repeated in 2020.

Hunting Seasons and Recreational Harvest

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 2018, 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 November 30. The bag limit is one goat of either sex, with horns longer than 4 inches. However, hunters are encouraged to shoot billies rather than nannies because mountain goat populations are sensitive to the removal of adult females. Beginning in 2018, hunters who drew a permit were required to successfully complete an online mountain goat gender identification training administered by WDFW. The 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 led to a 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 (i.e., older than kid) population, with 30% or less being females (WDFW 2015). Operationally, WDFW would reduce permit opportunity when the harvest of adult females exceeds 1.2% of the estimated number of animals older than kid within the hunt area, averaged over a 3-year period. Within Region 5, only the Goat Rocks/Tieton River Unit and the Mt. St. Helens area consist of populations large enough to support hunting under this guideline. Since the 2017, the aerial survey in the Mt. St. Helens and Mt. Margaret Backcountry indicated a goat population much greater than 100 individuals, a proposal for two new goat units (Mt. St. Helens South and Mt. Margaret Backcountry) with one goat tag each was sent to and approved by the WDFW Commission for the 2018 season. Surveys of other areas supporting goats will be conducted periodically. Should populations surpass 100 individuals in these areas, hunts could be considered.

Beginning in 2018, the Goat Rocks/Tieton River Hunt Area was split into two separate units: Goat Rocks West and Goat Rocks East. The purpose of this division was to provide for better spatial distribution of harvest within the Goat Rocks area so that the majority of the harvest and hunting pressure are not concentrated in one small area. Two tags were offered in the Goat Rocks West Hunt Area and three tags were offered in the Goat Rocks East Hunt Area during 2018. The permit holders in Goat Rocks West reported harvesting one billy and one nanny. The permit holders in Goat Rocks East faced the challenge of wildfire closures and one hunter harvested a billy (Table 3). Information on harvest by Tribal hunters during 2018 indicated the harvest of two billies and one nanny from the Goat Rocks population (NWIFC 2018). The 2018 hunting season was the first year for permits in the Mt. Saint Helens area. One permit each was issued for the Mt. Saint Helens South and Mt. Margaret Backcountry Hunt Areas. Both of those permit holders were successful in harvesting a billy (Table 3). Neither the auction nor the raffle goat permits were used in the Goat Rocks, Mt. Saint Helens South, or Mt. Margaret Hunt Areas in 2018.

Table 3: Region 5 Mountain Goat Hunt Summary 2009-2018.

Goat Unit	*Year*	*WDFW Permits Issued*	*WDFW Permit Harvest*	*Tribal Harvest[a]*	*Total Harvest*	*Total Billies Harvested*	*Total Nannies Harvested*
Goat Rocks	2018[b]	5	3	3	6	4	2
Goat Rocks	2017	5	5	2	7	5	2
Goat Rocks	2016	5	5	3	8	5	3
Goat Rocks	2015	5	4	1	5	4	1
Goat Rocks	2014	3	3	1	4	4	0
Goat Rocks	2013	3	3	1	4	3	1
Goat Rocks	2012	3	3	1	4	4	0
Goat Rocks	2011	3	4	0	4	4	0
Goat Rocks	2010	5	4	2	6	4	2
Goat Rocks	2009	5	5	0	5	5	0
Mt. Margaret Backcountry	2018	1	1	N/A	1	1	0
Mt. St. Helens South	2018	1	1	N/A	1	1	0
Note: Harvest exceeded permit numbers in 2011 due to hunting by Auction and Raffle Permit holders.							
[a]As reported by the Northwest Indian Fisheries Commission							
[b]In 2018, the Goat Rocks Hunt Area was split into two areas: Goat Rocks West and Goat Rocks East							

Habitat

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 (AMA) project indicate that in the four study areas (Stonewall Ridge, South Point Ridge, Smith Ridge, and Castle Butte) a total of 404 acres of alpine meadow 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 alpine meadows has likely continued. Thus, the need for restoration and preservation of these areas is paramount to continued healthy goat populations. 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 the summer of 2018, the Miriam fire burned approximately 5,400 acres in the northeastern portion of the Goat Rocks Wilderness (2019 InciWeb). Additionally, fires in the vicinity of Mt. Adams have occurred over the past several years. Another possible avenue to address conifer encroachment is through the use of girdling and snag creation.

Management Concerns

Disease testing on a limited number of samples collected by hunters in 2015 revealed evidence that 1 of 19 mountain goats tested may have been exposed to the bacterium *Mycoplasma ovipneumoniae* (*M. ovi*), which is associated with pneumonia outbreaks in bighorn sheep. This serological sample was collected from a goat harvested in the Goat Rocks. In 2017, all hunter harvested goats were sampled and all were negative for *M. ovi*. In 2016, both volunteers and WDFW staff conducted visual observations of goats in the Goat Rocks. The purpose of these surveys was to 1) observe goats for any signs of respiratory disease, and 2) count goats, including kids for evidence of any unusually high levels of early mortality that might be evidence of pneumonia infection. During the surveys no mountain goat carcasses were found, nor were goats with signs of lethargy, coughing, head shaking, or other indications of respiratory disease observed. Observations made by WDFW staff observed kid:nanny ratios of approximately 0.38. Pneumonia due to *M. ovi* is believed to be the cause of a decline in at least one mountain goat population in Nevada. The significance of the positive *M. ovi*-antibody test result from a single mountain goat in Washington is not known at this time. Nonetheless, WDFW will remain vigilant about reports of sick goats, collect samples when needed, and continue to collaborate with veterinary researchers at Washington State University to better understand the health of mountain goats in Washington.

Management Conclusions

Mountain goats in Region 5 are valued for both viewing and hunting opportunities. Additionally, the goats are of particular cultural value to the native people of southwest Washington. 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. The increase in the goat population around Mt. Saint Helens has been a benefit for viewing opportunities at the popular Mt. Saint Helens National Volcanic Monument visitor centers and trails. Now, with a population nearly as large as Goat Rocks, hunting opportunities are available as well.

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 biennial 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.

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.

Literature Cited

Hemstrom, M. A. 1979. A recent disturbance history of the forest ecosystems of Mount Rainier National Park. Ph. D. Thesis, Oregon State University, Corvallis, OR. 67 p.

InciWeb. 2019. Inciweb Incident Information System. Miriam Fire. https://inciweb.nwcg.gov/incident/6066/

Kogut, T. 1996. Trends in Natural Meadows within Mountain Goat Habitat, Cispus Adaptive Management Area. USFS Gifford Pinchot Nat. For. Unpublished Report. 9 p.

Northwest Indian Fisheries Commission. 2018. Big Game Harvest Report Western Washington Treaty Tribes.

Olmsted, J. 1979. Mountain goat winter habitat study. Job completion report, W_88 R_3. Wash. Dept. Of Game, Olympia WA. 50 p.

Rice, C., K. J. Jenkins and W-Y. Chang. 2009. A Sightability Model for Mountain Goats. Journal of Wildlife Management. 73 (3): 468-478.

Rice, C. 2012. Status of mountain goats in Washington. Northern Wild Sheep and Goat Council 18: 64-70.

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

Mountain Goat Status and Trend Report: Region 6

Olympic Mountains

BRYAN MURPHIE, Wildlife Biologist

Introduction

Mountain goats (*Oreamnos americanus*) are not native to the Olympic Mountains. They were introduced from Alberta and Alaska between 1925 and 1929 (Johnson 1983). Introductions occurred on the northern part of the Olympic Peninsula in the vicinity of Lake Crescent near Port Angeles and were conducted primarily by the Klahhane Club, a sportsman's group in Port Angeles at the time (Johnson 1983). The creation of the Olympic National Park (ONP) in 1938 provided complete protection for the introduced mountain goats and the population thrived. The goat population expanded its distribution to areas outside the ONP boundary, and by the 1980's the mountain goat population had reached an estimated 1,175 $\pm$ 171 (SE) goats throughout suitable range in the Olympics (Houston et al. 1994). Concerns over the negative effects of non-native mountain goats on endemic plant communities and soils in the ONP prompted an effort to reduce the goat population during the 1980s when 407 goats were relocated to mountain ranges outside the Olympics (Jenkins et al. 2012). An estimated 168 goats were harvested from 1980 until 1997, when the season was closed. No additional removals were conducted, and recreational hunting was closed from 1998-2013.

Following a period of relative stability at low numbers for several years, the mountain goat population increased (Jenkins et al. 2016), and mountain goats currently occupy areas within ONP and on USFS lands along the eastern portion of the Olympic Peninsula. Many of these areas are among the most popular hiking destinations in northwest Washington. As a result, concerns over human-goat conflicts and the negative effects of non-native mountain goats on endemic plant communities have reemerged. WDFW established a mountain goat permit hunt in a designated portion of the eastern Olympic Peninsula wilderness areas in 2014, in part to aid in addressing these concerns.

In 2018, WDFW partnered with ONP and USFS in a relocation effort moving mountain goats from the Olympics to the North Cascades in a project with dual purposes. As described in the Final Mountain Goat Management Plan/Environmental Impact Statement (EIS) (ONP, 2018) and in the USFS Record of Decision on the Final Mountain Goat Management Plan/EIS (USFS, 2018), the removal of mountain goats from the Olympics aids in addressing the concerns described above. Additionally, the mountain goat population in the North Cascades has undergone substantial declines leaving small, isolated populations in many areas. The translocation of Olympic mountain goats provides an opportunity to reestablish and augment the mountain goat population in the North Cascades, where they were historically.

Management Guidelines and Objectives

Due to the issues described above, the Olympic mountain goat population is not being managed for a sustainable harvest, in contrast to populations in the Cascades. Rather, the primary objective for the Olympic Mountain goat permit hunt is to provide a recreational hunting opportunity, while attempting to reduce the potential for conflicts between mountain goats and recreationists within the designated permit area by reducing the number of goats in these areas (WDFW, 2014).

Population Surveys

Estimates from surveys conducted in 2016, suggest there were 623 (95% CI = 561-741) goats on the Olympic Peninsula, including ONP and USFS lands (Jenkins et al. 2016). The estimate of goats for those areas surveyed within the designated permit hunt area was 59 (95% CI = 53-89) (K. Jenkins, personal communication). For comparison, Jenkins et al. (2012) estimated that the mountain goat population was 344 $\pm$ 72 in 2011 within the ONP. WDFW conducted surveys within predetermined goat survey blocks in the eastern portion of the Olympics, which included USFS and ONP lands, but not the entirety of goat habitat in the Olympics in 2012 and 2014. Sightability corrected estimates of 66 (90% CI: 51-81) total goats in 2012 and 94 (90% CI: 82-112) total goats in 2014 were generated (Rice 2012; Harris and Rice 2014).

Hunting Seasons and Recreational Harvest

Recreational hunting of mountain goats in Washington State began in 1897 with a bag limit of 2 goats per year and a 3-month season (Johnson 1983). In 1913, the bag limit was reduced to 1 goat, then in 1917 hunting was restricted to designated areas in the Cascades until goat hunting in Washington was closed entirely in 1925 (Johnson 1983). Mountain goat hunting by permit in designated hunt units in Washington resumed in 1948. Archery only goat permit hunts were established for three designated permit units in the Olympics in 1980; the Elwha, Quilcene and Hamma. An estimated 168 goats were harvested from 1980 until 1997, when the season was closed.

Hunting by permit was reopened in 2014 for two designated areas in the eastern Olympics, 6 permits were issued between 3 permit hunts. In 2015, the two designated permit areas were combined into one large unit (Figure 1) with 6 permits issued in a split season of 3 permits each. Hunter success has averaged 32% and 15 goats have been harvested during this permit hunt Figure 2). In 2018, Washington State hunters harvested 3 male goats. Tribal hunters have harvested at least five goats since 2014.

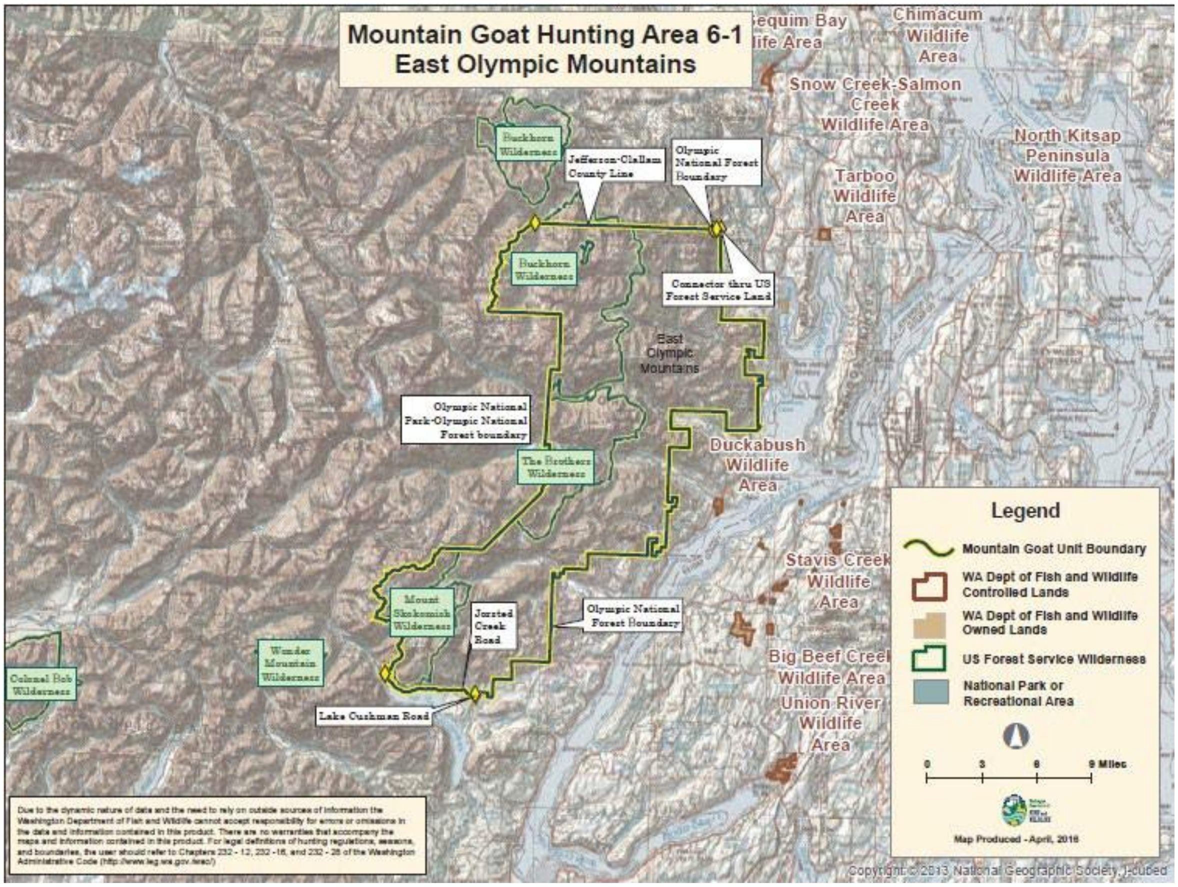

Figure 1. The designated mountain goat hunting area, 6-1, located on the eastern Olympic Peninsula, Washington.

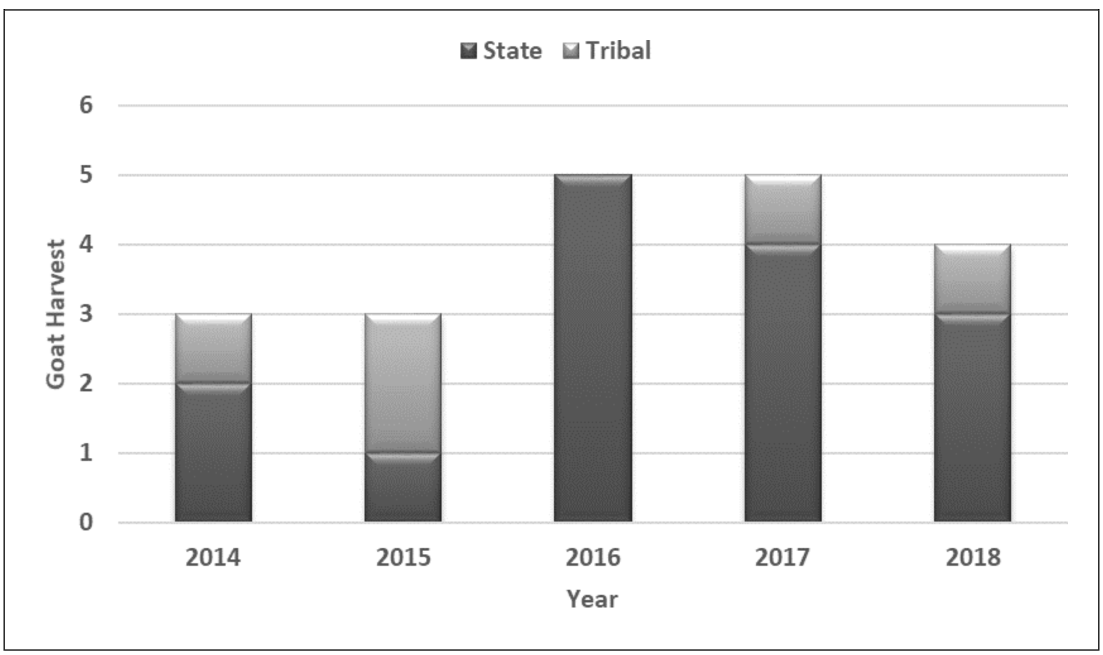

Figure 2. Total State and Tribal mountain goat harvest within the Olympic Mountain Goat Permit Hunt area from 2014-2018.

Survival and Mortality

Estimates of survival and causes of mortality are relevant for a specific time, place and population; and these data are not available for mountain goats on the Olympic Peninsula. Generally, causes of mortality include weather, nutritional stress, predation, parasites and disease, natural hazards (for example, avalanches), hunter harvest, and the confounding effects of many of these. Similar to other ungulates, survival is often lower among older adults and young of the year than among prime-aged individuals, and generally higher among females than males.

Habitat

Mountain goats primarily occupy habitats from just below timberline to the highest, rocky peaks in the alpine zone. In the Olympics, mountain goats are generally found at elevations above 1400m (Jenkins et al. 2011). They select habitats based on availability of forage, landscapes that provide high solar loading, and terrain that is rugged, providing escape from predators (Beus 2010). Mountain goats tend to exhibit strong site-fidelity to seasonal ranges, returning to the same summer and winter ranges year after year (Houston et al. 1994). Transition between seasonal ranges generally occurs in June to summer range, and October or November to winter range, but there is considerable individual variability in seasonal migratory behavior (Rice 2008, Jenkins et al. 2011). Summer diets consist primarily of graminoids and forbs, while during the winter they consume more tree and shrub species as part of their diet (Houston et al. 1994).

Human-Wildlife Interaction

Goats that have become accustomed to humans are often drawn to them for providing salt from food and urine. Encounters can range from mildly annoying to life-threatening. These primarily occur along popular hiking routes that traverse areas occupied by mountain goats in the designated Olympic permit hunt area, most notably along the Mount Ellinor and Lena Lake trails. Although numerous accounts of potentially hazardous encounters between humans and mountain goats have been reported, two occurrences in the Olympic Range illustrate the seriousness of the risk these types of encounters pose to humans. In 1999, a hiker on Mount Ellinor reported that he was gored in the leg by an aggressive goat and survived; and in 2010, a hiker at Hurricane Ridge was also gored in the leg, sustaining a fatal injury to his femoral artery (ONP Mountain Goat Action Plan, 2011).

Olympic Mountain Goat Removal Project

In 2018, the WDFW, ONP, and USFS initiated efforts to remove mountain goats from the Olympics to the North Cascades. Preliminary tallies of total goats removed from the Olympics are 115 in 2018 and 211 in 2019, for a combined total of 326. Of these, 31 were removed from the Olympic permit hunt area.

Management Concerns

As a result of an increasing goat population, concerns over human-goat conflicts and the negative effects of this non-native species on endemic plant communities have reemerged. The Department established the goat conflict reduction permit hunt in the eastern Olympics, in part to address these concerns. Additionally, the ONP, USFS, and WDFW initiated a removal effort of mountain goats from the Olympic Peninsula in 2018.

Management Conclusions

The mountain goat population in the Olympic Mountains was increasing prior to the current removal effort. This pattern generated concerns related to goat impacts on native plant communities and dangerous encounters with humans. WDFW will continue to work with Olympic National Park, US Forest Service, and other partners to address these concerns. In part, a major goat relocation effort began in 2018 with the objective to reduce the number of goats on the Olympic Peninsula, while augmenting native goat populations in the Cascade Mountains. This effort will continue for several years, shifting to areas outside of the Olympic National Park in 2019.

The Mountain Goat Conflict Reduction permit hunt in the east Olympic Mountains was not available during the 2019 season. Sixteen goats were translocated from the Mt. Ellinor area, and an additional 7 from the Brothers area in August 2019 as part of the NPS-WDFW translocation program. WDFW will evaluate how many goats remain in the East Olympic Hunt Area in 2020 and beyond to determine whether to reopen the Olympic mountain goat permit hunt.

Literature Cited

Beus, T. L. 2010. Habitat modeling using path analysis: delineating mountain goat habitat in the Washington Cascades. M.S. Thesis, Western Washington University. 105 p.

Harris, R. B. and C. G. Rice. 2014. Survey of mountain goats in Olympic National Forest, August 2014. WDFW Technical Report. 8 p.

Houston, D. B., E. G. Schreiner, and B. B. Moorhead. 1994. Mountain Goats in Olympic National Park: Biology and Management of an Introduced Species. National Park Service Scientific Monograph NPS/NROLYM/NRSM-94/25. 295 p.

Jenkins, K., K. Beirne P. Happe, R. Hoffman, C. Rice, and J. Schaberl. 2011. Seasonal distribution and aerial surveys of mountain goats in Mount Rainier, North Cascades, and Olympic National Parks, Washington: USGS Open-File Report 2011-1107. 56 p.

Jenkins, K. J., P. J. Happe, K. F. Beirne, R. A. Hoffman, P. C. Griffin, W. T. Baccus, and J. Fieberg. 2012. Recent population trends of mountain goats in the Olympic Mountains, Washington. Northwest Science Vol. 86, No. 4.

Jenkins, K.J., Happe, P.J., Beime, K.F., and Baccus, W.T., 2016, Mountain goat abundance and population trends in the Olympic Mountains, northwestern Washington, 2016: U.S. Geological Survey Open-File Report 2016-1185, 21 p.

Johnson, R. 1983. Mountain goats and mountain sheep of Washington. Washington Department of Game Biological Bulletin No. 18. 196 p.

ONP. 2018. Final mountain goat management plan/environmental impact statement. Olympic National Park, National Park Service, US Dept. of the Interior. 284 p.

Rice, C. G. 2008. Seasonal and altitudinal movements of mountain goats. Journal of Wildlife Management 72(8):1706-1716.

Rice, C. G. 2012. Survey of mountain goats in Olympic National Forest, September 2012. WDFW Technical Report. 8 p.

USDA Forest Service. 2018. Record of Decision mountain goat management plan/environmental impact statement (plan/EIS) for Olympic National Park. USDA Forest Service. 7 p.

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

Bighorn Sheep

Bighorn Sheep Status and Trend Report

STATEWIDE

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Management Guidelines and Objectives

In 2014, biologists managing bighorn sheep herds in Washington convened to reconsider herd-specific population objectives that had existed for years, been included 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.

Population Surveys

All bighorn sheep herds in Washington are surveyed annually. In 2016, 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.

Hunting Seasons and Recreational Harvest

Bighorn sheep hunting opportunity in Washington is limited to permit-only hunting. Permit availability, and therefore hunter opportunity, steadily increased in Washington until 2011, but has dropped since that time. (Figure 1). In 2018, 53 special season permits, 1 auction permit, and 4 raffle permit were available (including the potential from multi-species raffles) in 9 different sheep management units. Most 2018 bighorn sheep seasons were September 15 to October 10, (except 4 areas; either October 1-10 or November 3-30). Hunters had the choice of any legal weapon to harvest any bighorn ram (no curl restrictions), as well as ewe (in selected herds). In the Chelan Butte herd, selected hunters could also harvest only a juvenile ram. Of the 53 permits available in 2018 (including the auction and raffles), reports were received from 48 hunters, who reported killing 44 sheep (hunter success rate = 92%). Considering only 'any ram' draw permits, a total of 20 were available in 2017, of which 19 were reported harvested. Twenty-three ewes were taken from 31 available permits (including young and disabled hunter permits).

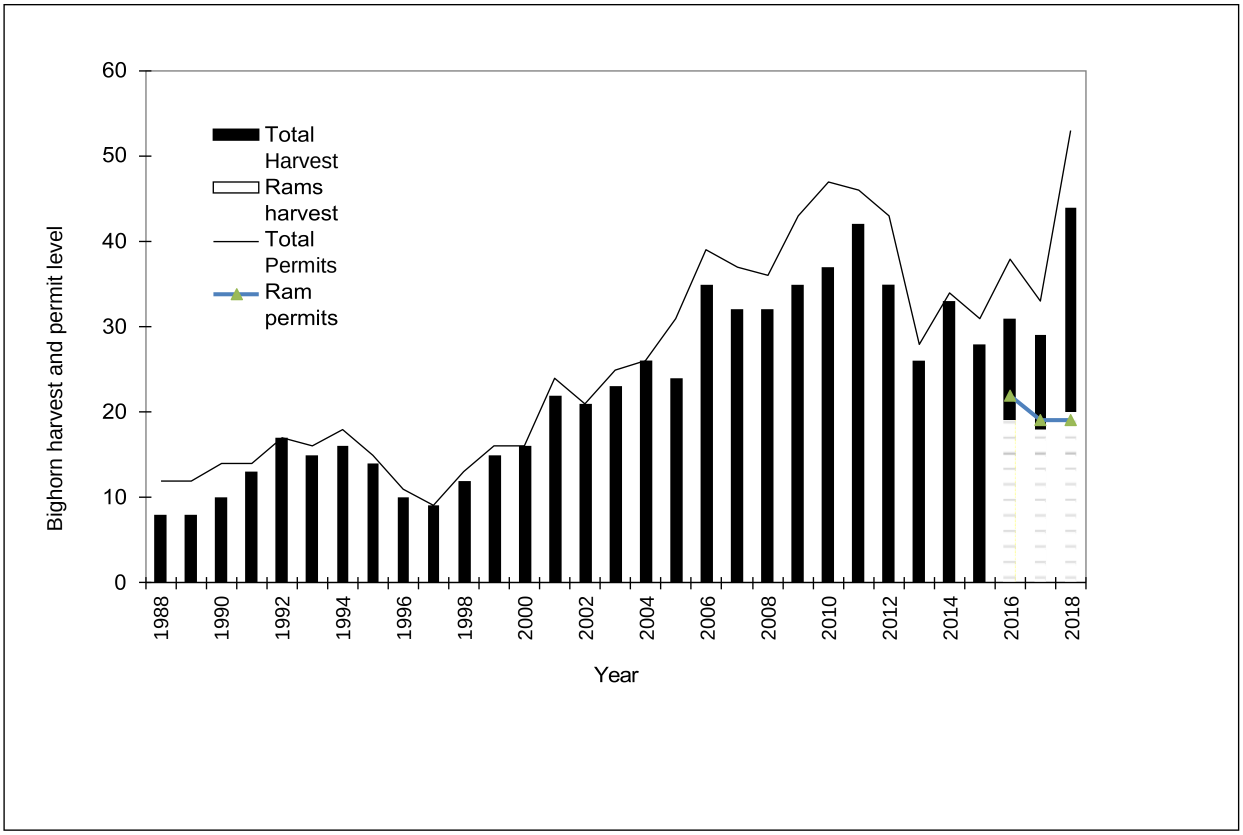

Figure 1. Regular draw permits (line) and harvest (bars) of all bighorn sheep in Washington, 1988-2018 (rams only indicated by triangle).

Survival and Mortality

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 and Tucannon bighorn herds, which have remained small (and are not currently hunted). In recent years, there are suggestions that the Blue Mountain herds, most of which have recently experienced disease outbreaks, have increased. 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). The Cleman Mountain, Chelan Butte, and Swakane herds were evidently at record high numbers in 2015. The Cleman Mountain herd has remained approximately stable since that time; surveys of the Chelan Butte and Swakane herds have been incomplete, but there is no evidence to suggest appreciable changes since 2015.

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. As of 2017, we have increasing optimism that the Asotin Herd may have cleared the bacteria responsible for pneumonia: researchers have been unable to document its presence, and lamb recruitment appears to have returned to normal levels. However, it will require a few more years before we can be confident of this. The Asotin herd has recently lost an excessive number of mature rams to treaty-rights hunting.

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. The results of this work appear in Heinse et al. (2016). Efforts to work with these small flock owners to reduce the risk of disease transmission are ongoing. WDFW has begun working with the Department of Corrections, Washington State University, and local sheep producers to begin a pilot project of raising domestic sheep free of *M. ovipneumoniae.* We hope ultimately to provide for owners of small herds near susceptible bighorn herds a source of sheep free of this particular pathogen, thus reducing the risk to bighorns.

'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. *M. ovipneumoniae* 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 *M. ovipneumoniae.* East of the river, there did not appear to be significant signs of disease, but *M. ovipneumoniae* 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 was 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 herd-wide during 2013, 2014, and 2015. Thus, it appears that the pneumonia has yet to completely clear from the Umtanum/Selah Butte herd (Bernatowicz et al. 2016).

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 mid-September 2013, the combination of the WDFW, 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 (Bernatowicz et al. 2016).

In 2018, *M. ovipneumoniae* was also documented in the Mt. Hull herd; we know of at least 11 deaths that are either confirmed or suspected to have resulted from pneumonia. The Mt. Hull herd appears to have declined somewhat from a high of over 100 animals a few years ago, but we remain uncertain how much, if any, of the decline is due to the pneumonia outbreak. We are hopeful this will turn out to be one of the mild outbreaks, with only modest mortality, and perhaps self-limiting.

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 begun to bounce back, as recent counts have been closer to the recent peak observed in 2011.

In 2014, WDFW obtained 2 young rams belonging to the Lookout herd in Oregon from the Oregon Department of Fish and Wildlife, both of which were placed in the Tucannon Herd to increase genetic diversity. In January 2016, we moved an additional 7 adult ewes from the Lookout Herd to the Tucannon Herd.

In March 2016, with the cooperation of the U.S. Fish and Wildlife Service and the Kalispel Tribe, WDFW obtained 21 short-yearling bighorn sheep from the National Bison Range (NBR) in western Montana. The NBR herd had grown to record size, and the USFWS was considering euthanizing most of these animals. After confirming that none of the 21 were infected or had been exposed to *M. ovipneumoniae*, we brought 11 animals to the Tucannon Herd, and 10 to the Hall Mountain Herd.

Habitat

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).

Literature Cited

Bernatowicz, J., D. Bruning, E. F. Cassirer, R. B. Harris, K. Mansfield, and P. Wik. 2016. Management responses to pneumonia outbreaks in 3 Washington State bighorn herds: lessons learned and questions yet unanswered. Biennial Symposium Northern Wild Sheep and Goat Council 20:38–61.

Heinse, L. M., L. M. Hardesty, and R. B. Harris. 2016. Risk of pathogen spillover from domestic sheep and goat flocks on private land. Wildlife Society Bulletin 40:625–633.

Washington Department of Fish and Wildlife. 2008. July 2009-June 2015 Game Management Plan. Wildlife Program, WDFW, Olympia, Washington, USA.

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

Bighorn Sheep Status and Trend Report: Region 1

Blue Mountains

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Introduction

Bighorn sheep (*Ovis canadensis*) were first restored in the Blue Mountains 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.

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 southeast Washington's bighorn sheep populations are included in the HCI; Black Butte, Mountain View, Wenaha, Tucannon, and Asotin Creek.

Management Guidelines and Objectives

Population 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. In 2015, WDFW recognized the utility of differentiating short-term objectives from long-term objectives (http://wdfw.wa.gov/conservation/game/). Short-term objectives take 2014 population sizes as a starting point, account for existing constraints to population growth, and account for what can realistically be achieved within the 6-year planning horizon that WDFW uses (WDFW, 2014). Long-term objectives reflect the potential of habitat to support bighorns assuming that constraints such as disease and land-owner tolerance can be resolved. For the Tucannon herd, short-term objective was identified as being in the range 40-80, and the long-term potential was estimated to be approximately 160. For the Mountain View and Wenaha herds combined, short-term objective was bounded by 130-170, with the long-term potential estimated at 375. The short-term objective for the Asotin Creek herd was estimated at 120-130, whereas the potential of the area was estimated to be 240 animals. The short-term objective for the Black Butte herd were estimated to be 50-60 animals, and the long-term potential, reflecting the past abundance of this herd, was estimated to be 585. Thus, for the Blue Mountains herds in aggregate, the short-term objective is to have 340-440 animals; we estimate that ideally the area could ultimately support approximately 1,360 if disease and landowner tolerance issues were resolved.

Population Surveys

Aerial surveys have not been conducted since 2015 because ground counts have proven adequate for estimating population parameters. Ground counts were obtained for the five herds during March and April of 2019. The minimum population estimate for 2019 (for all herds aggregated) was 327 (154 ewes, 78 lambs, 94 rams, i.e., ratios of 61 (90% CI: 48-74) rams and 51 (90% CI: 39-62) lambs (just prior to them becoming yearlings) per 100 ewes (Table 1). A population estimate using the sightability correction has not been developed for 2019 at this time, but we estimate that there were approximately 340-360 bighorns in the 5 herds, of which a number inhabit Oregon throughout the year. Lamb recruitment during the 2018-2019 biological year was the highest recorded since the 1996-1997 die-off.

Hunting Seasons and Recreational Harvest

Recreational hunting opportunity was limited to one raffle permit in 2018. Poor recruitment (past years), research and conflict removals, past harvest, and tribal harvest continues to limit the available recreational opportunity. One ram was harvested from the Wenaha herd during 2018. Efforts are being made to work with local tribes with treaty rights to limit the current harvest to allow for recovery of the male segment of the population. In 2018, known tribal harvest accounted for 5 bighorn sheep (2 ewes and 1 yearling ram in Asotin, 1 adult ram in Black Butte, and 1 adult ram in Mountain View).

Survival and Mortality

Survival analysis has not been completed at this time for the 2018-2019 biological year. The Hells Canyon Restoration Committee will produce an annual report during the fall of 2019 that captures this information.

Habitat

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 that 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. During the summer of 2015, the Grizzly Complex wildfire burned a large portion of the Wenaha herd range. It is not yet clear what effect this may have on the habitat within this herd range.

Human-Wildlife Interaction

Bronchopneumonia caused by, or facilitated by, the bacteria *Mycoplasma ovipneumoniae* (*M. ovi*, hereafter) has affected 4 of the 5 Blue Mountain bighorn populations in Washington; Asotin, Black Butte, Wenaha, and Mountain View. Bighorn populations in the Hells Canyon area generally (which includes the Washington Blue Mountain herds, but also nearby herds in Oregon and Idaho) have not recovered from bronchopneumonia die-offs as quickly as some herds in other states, possibly because of reinfection from adjacent herds or 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 insure accurate disease information is available to stock owners and options to minimize contact between domestics and wild sheep are made available. To facilitate this outreach to owners of domestic sheep and goats, WDFW has partnered with Idaho Fish and Game, Oregon Department of Fish and Wildlife, and state chapters of the Wild Sheep Foundation from Washington, Idaho, and Oregon to fund a full-time position with the Asotin County Conservation District. This person will provide education and testing options to owners, or potential owners of domestic sheep and goat within the northern Hells Canyon ecosystem. The goal of this position is to reduce or eliminate risk of disease transmission from domestic animals to bighorn sheep populations.

Some land-management 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 risk to bighorn sheep populations in southeast Washington. WDFW staff actively work to explain the risk of using domestic Caprinae species within the ranges of bighorn sheep.

Population Augmentation

No population augmentations occurred during this reporting period.

Research

As part of the Hells Canyon Restoration committee, WDFW is actively participating in research on *M. ovi*-associated pneumonia in bighorn sheep (e.g., Bernatowicz et al. 2016, Manlove et al. 2014, Cassirer et al. 2017, 2018). For the past 4 years, WDFW and IDFG researchers have been capturing ewes and lambs in the Asotin, Black Butte, Mountain View, Wenaha, and herds in Oregon and Idaho to determine the bacterial shedding status of animals within those populations. Efforts have been made to remove the chronic shedders of *M. ovi* in these herds, ideally increasing the survival and recruitment of lambs in the future. Additional information can be found at the 2017-18 Hells Canyon Initiative Annual Report.

Management Concerns

Disease, predation within some herds, and harvest among co-managers in certain herds remain the biggest challenges for bighorn sheep in the Blue Mountains. A long-term solution to pneumonia spreading within and amongst herds of bighorns has eluded researchers and managers for many years. In the Blue Mountains, disease has been proven to be the limiting factor for population growth for more than 20 years. Managers will need to continue investing in this problem in order to eliminate future outbreaks and recover from existing exposures.

Within the Washington Blue Mountains, 3 government entities have harvest rights to the bighorn sheep herds (WDFW, Confederated Tribes of the Umatilla Indian Reservation, and Nez Perce Tribe). These 3 entities have begun working toward common population goals and harvest regimes to maintain these goals. This will likely be a multi-year process but coming to an equitable approach for all entities will be the ultimate goal.

Management Conclusions

Four of the five bighorn sheep herds in the Blue Mountains have struggled with *M. ovi* induced bronchopneumonia. No bighorn documented M.ovi. pneumonia have occurred in the past 2 years in the Washington herds. This is likely a result of the “test and remove” management actions currently being conducted by the Hells Canyon Restoration efforts. The multi-state effort to remove chronic shedders of the M.ovi. bacteria will continue in Hells Canyon over the coming years. This will not prevent future contact with infected bighorns from other herds or domestic animals.

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. 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

Bernatowicz, J., D. Bruning, E. F. Cassirer, R. B. Harris, K. Mansfield, and P. Wik. 2016. Management responses to pneumonia outbreaks in 3 Washington State bighorn herds: lessons learned and questions yet unanswered. Biennial Symposium Northern Wild Sheep and Goat Council 20:38-61.

Cassirer, E. F., K. R. Manlove, R. K. Plowright, and T. E. Besser. 2017. Evidence for strain-specific immunity to pneumonia in bighorn sheep. Journal of Wildlife Management 81: 133-143.

Cassirer, E. F., K. R. Manlove, E. S. Almberg, P. L. Kamath, M. Cox, P. Wolff, A. Roug, J. Shannon, R. Robinson, R. B. Harris, B. J. Gonzales, R. K. Plowright, P. J. Hudson, P. C. Cross, A. Dobson, and T. E. Besser. 2018. Pneumonia in bighorn sheep: risk and resilience. Journal of Wildlife Management 82: 32-45.

Hells Canyon Initiative, Annual Report 2014-2015. 2015. Idaho Fish and Game, Lewiston, USA.

Manlove, K.R., E. F. Cassirer, P. C. Cross R. K. Plowright, and P. J. Hudson. 2014 Costs and benefits of group living with disease: a case study of pneumonia in bighorn lambs (*Ovis canadensis*). Proc. R. Soc. B 281: 20142331. http://dx.doi.org/10.1098/rspb.2014.2331

Washington Department of Fish and Wildlife. 2008. 2009-2015 Game Management Plan. Washington Department of Fish and Wildlife, Olympia, WA.

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

			Rams						Population	Ratio (90% CI)	
Year	Lambs	Ewes	C I	C II	C III	CIIIB	C IV	Total	Total	Lambs	Rams
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)
2016	58	129	7	9	20	2	0	79	268	45 (33, 57)	61 (47, 76)
2017	65	164	16	17	16	1	8	76	342	40 (30, 49)	46 (36, 57)
2018	67	172	26	29	23	5	1	92	330	39 (30, 48)	53:100:39
2019	103	154	10	30	0	6	63	216	0	51 (39, 62)	61 (48, 74)

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
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)
2016	16	32	0	3	11	0	0	24	72	53 (26, 80)	80 (44, 116)
2017	15	40	3					19	74	37 (19,56)	47 (26, 69)
2018	16	47	6	7	4		1	18	81	34 (18, 50)	38 (21, 56)
2019	8	28	4	2	6	0	1	13	49	28 (10, 47)	46 (21, 72)

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
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)
2016	5	10	4	1	1	2	0	8	25	50 (5, 95)	80 (18, 142)
2017	10	14	2	4	3	1	1	11	35	71 (23, 120)	79 (26, 131)
2018	5	16	5	3	6	3		17	38	31 (5, 58)	106 (45, 167)
2019	11	19	6	2	12	1	0	21	51	58 (22, 94)	110 (53, 168)

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
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)
2016	15	28	2	1	4			15	58	54 (25, 82)	54 (25, 82)
2017	14	44	2	5	5		4	15	90	32 (16, 48)	34 (17, 51)
2018	24	36	7	4	6	1		21	80	67 (38, 96)	58 (32, 85)
2019	22	36	7	4	5	1	0	17	72	61 (34, 88)	47 (24, 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
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			5	21	33 (2, 65)	42 (5, 78)
2013	3	12	3	1	2	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)
2016	0	17	1	4	4	0	0	9	26	0 (0, 0)	53 (17, 89)
2017	2	13	2	3	3	0	0	8	23	15 (0, 34)	62 (16, 107)
2018	3	14	2	1	1			4	21	21 (0, 44)	29 (2, 55)
2019	7	13	1	2	2	0	0	5	25	54 (12, 95)	38 (5, 72)

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
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)
2016	22	42						23	87	52 (29, 75)	55 (31, 78)
2017	24	53	7	5	5		3	23	120	45 (27, 64)	43 (26, 61)
2018	19	59	6	14	6	1		32	110	32 (18,46)	54 (35, 74)
2019	30	58	15	23	12	1	2	38	130	52 (33, 71)	66 (43, 88)

Table 6. Wenaha herd 10-year survey history

Bighorn Sheep Status and Trend Report: Region 1

Hall Mountain and Vulcan Mountain

ANNEMARIE PRINCE, Wildlife Biologist

Introduction

District 1 has two bighorn sheep populations, both resulting from reintroductions. Rocky Mountain bighorn sheep were initially 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.

Management Guidelines and Objectives

An earlier objective for the Hall Mountain herd was to maintain a population of 40-70 Rocky Mountain bighorn sheep (WDFW 2014). However, population objectives have recently been revised to reflect updated mapping of suitable habitat (http://wdfw.wa.gov/conservation/game/). Short-term early winter herd objectives are between 25-35 animals.

The earlier long-term population goal for the Vulcan Mountain bighorn sheep herd was to maintain 80-110 animals on the available range. However, population objectives have recently been revised to reflect updated mapping of suitable habitat (http://wdfw.wa.gov/conservation/game/). Short-term early winter herd objectives for the Vulcan herd are from 70-90 animals. Long-term, we estimate that the Vulcan area could support 80-110 animals.

Population Surveys

No aerial surveys of the Hall Mountain herd were conducted by WDFW during 2018/19. However, an aerial survey was conducted by the Kalispel Tribe in April 2019. Table 1 summarizes the maximum number of sheep observed during aerial surveys.

Table 1. Counts of Hall Mountain bighorn sheep, 2001-2019.
Note: The last year of winter feeding was in 2003.

Year	Lambs	Ewes	Rams	Total*	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				
2016	0	5	8	12	0:100:160**
2017	0	6	9	15	0:100:150
2018	No surveys conducted				
2019	0	5	4	9	0:100:80

* Total counts some years include unclassified bighorn sheep.
** Ground-based surveys conducted in spring before translocation of NBR sheep.

The Vulcan herd is surveyed annually with ground-based surveys conducted along an automobile route on county roads as well as from private and primitive roads. During the survey, biologists attempt to classify every detected bighorn sheep, but recognize that the effort likely never results in a complete count, and classification is not possible for animals at extreme distances. In 2018, a ground-based survey was conducted in December. The count recorded was 56 bighorn sheep (22 ewes, 13 lambs, 5 yearlings, and 16 rams). (Table 2).

Table 2. Annual population composite counts of the Vulcan Mountain bighorn sheep, 2001-2018.

				--- Rams ---				
Year	**Lambs**	**Ewes**	**Yearling**	**<3/4 curl**	**>3/4 curl**	**All rams**	**Total***	**Lambs:100 Ewes: Rams**
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
2015	13	19	13	6	7	13	45	68 : 100 : 68
2016	11	26	5‡	4	4	13	50	46 : 100 : 54
2018**	10	26	1	6	12	19	55	38 : 100 : 73
2019	13	22	5	12	4	16	56	59 : 100 : 72

* Total counts some years include unclassified bighorn sheep.
**These counts were conducted by helicopter.
‡ All males.

Hunting Seasons and Recreational Harvest

The Hall Mountain herd is open for the Rocky Mountain special raffle permit hunt, however, there have been no bighorn sheep harvested there since 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. There were no state permits or tribal permits allocated for 2018.

Table 3. Summary of State permit numbers and State hunter harvest of bighorn sheep from the Vulcan Mountain Unit, 2005-2016.

Year	State	State Hunter Harvest
2005	1	1 ram
2006	1	1 ram
2007	2	2 rams
2008	3	1 ram, 2 ewes
2009	4	1 ram, 3 ewes
2010	4	1 ram, 3 ewes
2011	2	1 ram
2012	1	1 ram
2013	1	None
2014	1	1 ram
2015	1	1 ram
2016	1	None
2017	0	None
2018	0	None

Survival and Mortality

Predators that occur throughout the Hall Mountain herd area include coyotes, black bears, cougars, and gray wolves. Three mortalities (all females) were documented among 8 GPS-collared sheep introduced from the National Bison Range (See below). One mortality was attributed to a cougar and the other two were classified as unknown; all mortalities occurred during the winter.

Predators that occur throughout the Vulcan herd area include coyotes, black bears, cougars, and gray wolves. During 2018, three mortalities (all ewes) were documented among 8 radio-collared sheep. All mortalities were classified as unknown due to the amount of time that elapsed before being able to retrieve the collars. Interestingly, one of the collars was located in a golden eagle nest.

Habitat

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 must travel through valley bottoms and dense forest where vulnerability to predators may increase.

The U.S. Forest Service (USFS) owns most of the land within the range of the Hall Mountain herd. Consequently, there are no immediate threats to habitat quality and quantity. The USFS plans to actively manage portions of the winter range habitat with prescribed burns subject to funding (Suarez 2001). In July and August of 2017, an approximately 4,000-acre fire burned portions of the Hall Mountain bighorn sheep range. This fire may increase forage quality in the future for this herd, however most of the trees within the sheep range were not affected by the fire. Currently, there is no domestic livestock grazing within the national forest area used by the Hall Mountain bighorn sheep.

Several projects to enhance habitat for the Vulcan Mountain Bighorn Sheep have been carried out in recent years. 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 Wild Sheep Foundation (WSF, formerly Foundation for North America Wild Sheep, FNAWS), the Safari Club International (SCI), the Inland Northwest Wildlife Council (INWC), the USFS, the Bureau of Land Management (BLM), and the WDFW. One 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, and to increase forage production (Doloughan 2004). In addition, a forest health/thinning project occurred on DNR property above Moran Meadows. There are no domestic sheep grazing allotments within the Vulcan herd range.

Human-Wildlife Interaction

A winter-feeding station was maintained for the Hall Mountain bighorn sheep for many years until it began attracting cougars, posing a risk to humans and an unnatural vulnerability for the sheep. Consequently, winter feeding was discontinued in 2003. More recently, there is concern about bighorn sheep straying beyond their traditional range and increasing the risk of contact with domestic sheep that could harbor *M. ovipneumoniae* (M. ovi.), a bacterium that causes pneumonia in bighorn sheep.

Population Augmentation

In March of 2016, 10 short-yearling (born in spring 2015) bighorn sheep (8 ewes, 2 rams) were translocated from the National Bison Range in Montana to Hall Mountain. All sheep were fitted with GPS radio-collars, tested negative for *Mycoplasma ovipneumoniae* on both nasal swabs and serology, and released at the historic feeding station in the USFS Noisy Creek campground. Unfortunately, two of these translocated ewes moved into residential areas and had to be euthanized because of potential interaction with and transmission of pathogens from domestic sheep and/or goats. There is one collar still functioning and present on Hall Mountain at the time of this writing. Cooperators in this project included the U.S. Fish and Wildlife Service, the Kalispel Tribe, Pend Oreille Sportsman's Club, the Montana Department of Fish, Wildlife, and Parks, the Confederated Salish and Kootenai Tribes, and Global Wildlife Resources.

In January of 2017, 8 sheep were translocated from the Cleman Mountain herd to the Vulcan herd area. All were fitted with GPS radio-collars and released at Vulcan Mountain. As of this writing, 4 of the sheep are still alive and spend the majority of their time on Vulcan Mountain.

Research

In 2016, the Kalispel Tribe, WDFW, the US Forest Service, and the Pend Oreille Sportsman's Club began a collaborative research project at Hall Mountain. Objectives of the study are as follows:

1. Estimate ewe and lamb abundance with the assistance of VHF telemetry during multiple helicopter flights.
2. Determine adult and lamb (up to 1 year) survival rates and when possible cause-specific mortality of radio-collared adult sheep.
3. Determine habitat use and movement patterns of Hall Mountain bighorn sheep using GPS locations of radio-collared individuals. Compare GPS locations from radio-collared sheep to the USFS habitat suitability model; determine the proportion of GPS locations that fall within the USFS model. Evaluate bighorn sheep movement and timing of movement between Hall Mountain (US Selkirk Mountains) and the B C Selkirk Mountains.
4. Use DNA collected at bait/capture sites in Washington and BC to understand the genetic relatedness and diversity within the Hall Mountain sheep population. If genetic diversity is low, investigate the possibility of releasing Rocky Mountain bighorns from another herd to increase genetic diversity.
5. Assess general health of Hall Mountain and BC bighorn sheep. Conduct disease testing, pregnancy tests, check for external parasites, and determine body condition (via ultrasound) during captures.

A bait station was established during the winter of 2015 and 2016 to attract sheep into a corral for capture and subsequent radio-collaring. Unfortunately, no sheep came to the capture site. However, 10 sheep were translocated from the National Bison Range in Montana to Hall Mountain in an effort to address objective four above and to provide a sample of radio-collared sheep for addressing the other objectives. Two of these sheep are still alive and transmitting locations. Aerial captures to radiocollar additional sheep were scheduled for the winter of 2017-18, but an accident involving the capture company (not at Hall Mtn.) prevented any capture attempts. In late winter of 2017-18, the Kalispell Tribe deployed 5 radiocollars (2 ewes, 3 rams) on sheep north of the US border to determine movement between BC sheep and the Hall Mountain population. As of this writing, the sheep have remained north of the border.

In February 2016, WDFW, with assistance from Leading Edge Aviation, captured 7 adult bighorn ewes at Vulcan Mountain. Six of the sheep were fitted with GPS radio-collars and all the sheep were screened for pathogens and diseases of interest. In addition, 8 radio-collared sheep were added to the Vulcan herd from the Cleman Mountain herd in 2017. Radio-collared ewes will be used to locate lambs and assess recruitment into the population. In addition, the collars will aid in finding sheep during any future helicopter surveys. As of this writing, there are currently 6 active and functioning collars in the Vulcan Herd area (Figure 1).

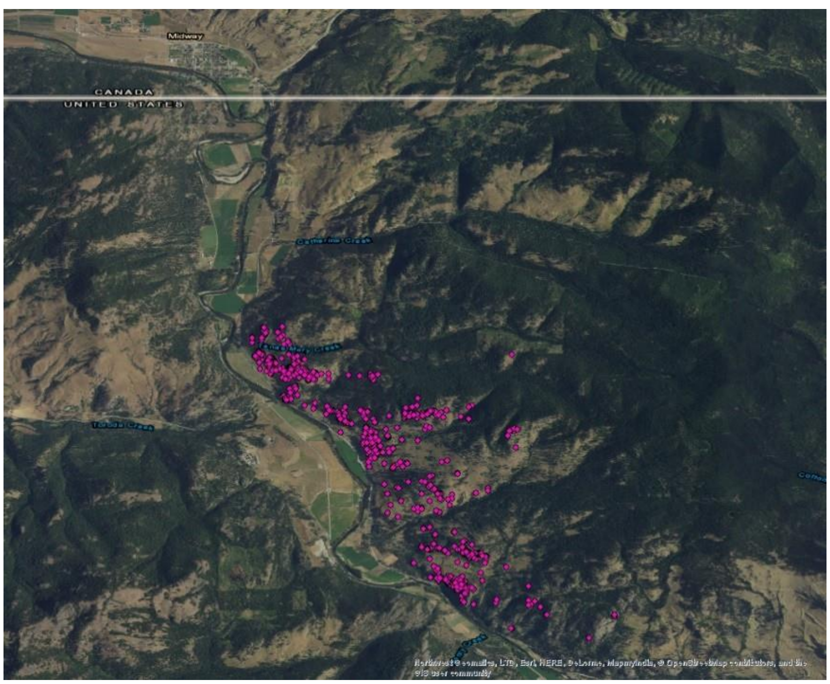

Figure 1. Map of GPS locations from 6 bighorn sheep ewes on Vulcan Mountain, June 2018-June 2019.

Management Concerns

Growth of the Hall Mountain bighorn sheep herd appears to be limited and the cause(s) of this limitation is undetermined. The Hall Mountain bighorn herd is considered a clean herd by WDFW, meaning there are no documented cases of *M. ovipneumoniae*. However, recent collar data indicates this herd may wander farther than previously thought and interactions with domestic sheep and goat herds is a concern. Winter surveys indicate this herd is very small and the future of the herd is uncertain.

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 2 small flocks of domestic sheep and goats near the periphery of the Vulcan range and are concerned about the potential for pathogen transmission from domestic sheep and goats to the Vulcan herd. These flocks have been tested for *M. ovipneumoniae* and are currently clean, however if new animals enter the flocks that status could change.

Management Conclusions

More intensive monitoring and research will help the Department better understand the dynamics of the Hall Mountain herd and determine the future potential of sustaining and/or increasing this herd.

The decline observed in the Vulcan herd 2009-2012 is of considerable concern, but there is some evidence (survey numbers) that the population has increased during the past few years. The population estimate has nearly doubled since 2012. There are currently 6 radio-collared sheep in the Vulcan herd and in subsequent years. We hope to better understand the limiting factors for this herd by monitoring these animals.

Literature Cited

Borysewicz, M. 2012. Colville National Forest: Sullivan Lake Ranger District. Personal communication.

Doloughan, K. U.S. Dept. of Interior: Bureau of Land Management. Personal communication, 2004.

Hall, P. B. Washington Department of Fish and Wildlife. Personal communications, 1999-2002. Johnson, R.L. 1983. Mountain Goats and Mountain Sheep of Washington. Biol. Bull. No. 18.

Wash. State Game Dept., Olympia. 196 p.

Krausz, E. Colville Confederated Tribes. Personal communications, 2006-2012.

Mansfield, K. Washington Department of Fish and Wildlife. Personal communication in 2007. Suarez, R.V. 2001. Lake Basin Prescribed Burn. Sullivan Lake Ranger District, Colville National.

Forest. Rocky Mountain Elk Foundation Project Completion Report - Unpublished. 2 p.

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

Bighorn Sheep Status and Trend Report: Region 1

Lincoln Cliffs

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Introduction

Bighorn sheep were reintroduced into the Lincoln Cliffs area in 1990. Sheep distribution was historically centered on the original 1990 release site, 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. The sheep now regularly occupy two main areas throughout the year: 1) the residential community of Lincoln and the cliffs above it, and 2) the cliffs around Whitestone Rock (about 7 miles downriver from Lincoln). Bighorn sheep have also been observed frequently using the cliffs above Sterling Valley, the area between Lincoln and Whitestone. Agricultural fields above cliffs and in valley bottoms are also used regularly by the bighorns. Observations of bighorn sheep have been reported as far east as Porcupine Bay on the Spokane Arm of Lake Roosevelt and as far west as Banks Lake in Grant County.

Management Guidelines and Objectives

The objective for the Lincoln Cliffs herd is to manage bighorn sheep numbers for a self-sustaining population capable of supporting both consumptive and non-consumptive recreation, while remaining within the local landowners' tolerance. The short-term objective for the Lincoln Cliffs herd is to maintain a population size of 100-120 (https://wdfw.wa.gov/publications/01676). This is likely the largest feasible herd size (and thus also the long-term objective) due to increasing landowner concerns and available habitat constraints.

Population Surveys

Aerial surveys have been the preferred method for surveying this herd due to the cliff habitat and lack of road access. Prior to 2002, aerial surveys were inconsistent due to limitations of 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 (Table 1), and one in late fall to assess ram numbers (Table 2). Review of that data showed that the fall flight produced greater ram and ewe counts 90% of the years and greater lamb count 50% of the time. Consequently, for staff safety and budgetary reasons it was decided to fly only the fall aerial survey beginning in 2014.

Minimum population estimates are based on the highest count of rams and ewes from all helicopter surveys in a given year (Figure 1). These surveys indicate the Lincoln Cliffs population experienced a period of steady growth 2007-2014, after which it has stabilized (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, a result of the auction and raffle permit holders selecting the Lincoln herd to hunt. The ram population rebounded immediately after 2006 and had, until 2013, remained fairly stable at around 20 animals. In 2014, 38 rams were observed during aerial surveys, which was the largest number since regular surveys began in 2002. In particular, the number of younger (¼- and ½-curl) age classes showed a considerable increase. The total number of bighorns observed on the 2018 flight, including lambs, was 88 (20 rams, 49 ewes, 19 lambs). Three collared animals were not located on the flight, and it is suspected they were among one or more groups that were missed on the flight.

Herd composition results from the aerial surveys have varied from 39 to 78 rams per 100 ewes over the last 10 years (Table 2). The lamb per 100 ewe ratio has remained relatively stable, although yearly 90% confidence intervals are large (Table 1). The exception was in 2014, when concerns were raised as only 7 lambs were located during the fall aerial survey, all in the Whitestone area. This confirmed what had been reported from public ground observations of the Lincoln group. The cause for this one-off year is unknown, testing during the 2015 capture (see research section below) indicate that *Mycoplasma ovipneumoniae* was not present in this population.

Ground counts are conducted whenever possible to supplement the aerial surveys; however, these are often very limited due to terrain and limited access to private property. Ground counts for ewes and lambs have been relatively easy to obtain in the Lincoln group, but less so for the Whitestone group. Ram counts in both areas have proven largely unsuccessful from the ground. Ground counts were conducted regularly during the spring and summer of 2015 and occasionally in 2016-2019 to monitor lamb production and survival. Lamb counts have indicated the recruitment failure of the Lincoln sub-herd in 2014 was a singular event. Residents in Lincoln have also been very helpful in reporting counts and other observations of this group.

Hunting Seasons and Recreational Harvest

One ram permit for this herd was offered each year from 1997-2013. 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. Lincoln Cliffs herd was closed to the raffle and auction winners from 2006-2014, in 2015-2017 it was open but none of the winners chose to hunt in this herd. In 2014, based on ram numbers and population size, general draw ram permits were increased to two. The Department introduced a ewe hunt in 2018, with one permit available for the Lincoln sub-herd and one for the Whitestone sub-herd.

Ram permittees 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. Hunter success has remained at 100% for this hunt, which had 2,018 applicants in 2018. Both ewe permittees were also successful in 2018, each spending 2 days hunting.

Survival and Mortality

Since 1997, 52 known sheep mortalities (40 rams, 12 ewes) have been documented in this herd: 30 from hunting, 2 from vehicle collisions, 7 from cougar predation, and 13 from unknown causes. The last reported non-hunting mortality occurred in May 2017, when residents witnessed two cougars chase a ewe off a cliff in Sterling Valley. Frequent cougar activity was reported in Lincoln during the spring and summer of 2018 and the spring of 2019. It is unknown if lamb and/or adult survival were affected, however we suspect that the 2014 lamb crop failure in the Lincoln sub-herd was caused by cougar predation.

Habitat

Habitat within the range of the Lincoln Cliffs bighorn sheep is primarily private land. Where intact, it includes sparse ponderosa pine, bunchgrasses, forbs, shrubs, and rock outcrops. The cliffs along the bank of Lake Roosevelt provide escape terrain and lambing areas. The flats above the cliffs are mainly dry land agricultural fields such as wheat and barley. Fields used by the sheep adjacent to roads in valley bottoms contain irrigated alfalfa and other crops. Much of the area has been broken into small parcels and developed, and landscaped residential areas are frequented by the sheep.

Human-Wildlife Interaction

Damage complaints related to bighorns in both the Lincoln and Whitestone areas have been on the rise. With the growth of this herd, agricultural activities adjacent to escape terrain, and recent drought conditions some 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. Ewe permits were also issued for the first time in 2018 to help address the growing concern.

Growth in the local human population and associated construction of new housing continue to be a concern in Lincoln. The Lincoln group of sheep spends substantial amounts of time near residences, so this may become an issue in the future if landowner tolerance changes. At the request of some residents, WDFW has worked with the Wild Sheep Foundation to investigate the feasibility of installing sheep crossing signs in Lincoln, where roads are driven frequently by visitors and risk of collision is significant.

Population Augmentation

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. The population showed a steady increase over the following years, and reportedly peaked at around 100 animals in June 1998 (personal communication, J. Hickman). As a result of such growth, the herd was used to augment other populations in the state from 1999-2001. Sixteen ewes and 1 ram lamb were translocated to Lake Chelan, and 11 ewes were captured and released on Cleman Mountain. Aerial and ground surveys in 2002 indicated that population was not recovering from the removal of ewes. 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). There have been no augmentations to this population since 2003.

Research

In February 2015, 10 sheep (8 ewes and 2 rams) were captured and fitted with GPS-enabled radio collars. Animals captured in 2015 were 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 (M. ovi)* exposure and active infection. *M. ovi*, a respiratory pathogen that predisposes wild sheep to pneumonia, is associated with domestic sheep or goat contact. An outbreak can cause high lamb mortality and persist in populations for decades. All bighorns captured in 2015 tested negative for *M. ovi*. Radio collars deployed in this capture aided in location of sheep during lamb monitoring and during aerial surveys. In addition, the GPS data collected from the collars provided insight into the movements and habitat use of the ewes and rams in the Lincoln and Whitestone groups. There appears to be little to no interaction between ewes in the Lincoln and Whitestone groups, although the rams showed regular movement between the two areas (Figure 2). None of the collared sheep went on any large forays out of the known use area during their collar lifetime.

To date, one known mortality has occurred for the 10 sheep that were radio-collared in the February 2015 capture. This ewe was killed by a cougar in September 2015, though later testing indicated she had contracted the bluetongue virus and was in poor condition. One ewe's collar battery failed before the end of May 2015; this collar was an older collar redeployed on this capture. Though the collar's GPS and VHF are no longer functioning, the ewe has been seen on subsequent survey flights. One ewe that was marked only with an ear-tag was also seen on the 2015 and 2016 flights. Additionally, one ram collar stopped its GPS transmittal in March 2016; the fate of that ram is unknown as it was not seen, or the VHF heard on any subsequent aerial or ground surveys. All remaining collars in this herd have now stopped transmitting; the remaining ewe collars failed during the fall of 2017, and the ram collar failed in August 2018.

Management Concerns

Though the Lincoln Cliffs herd is considered "clean," (i.e., there have been no documented cases of *M. ovi.*) disease continues to be a concern, given the close proximity to rural private lands. This is important should it ever be considered as a source population to augment failing herds in Washington. In addition, there are over 200 bighorn sheep on the Hellgate Game Reserve, located across Lake Roosevelt within the Colville Reservation boundaries. In 2015, an ear-tagged ewe was observed in Lincoln from the Hellgate population. And in 2019, the remains of an ear-tagged ewe translocated from Tieton to Hellgate in 2010 was found in the Lincoln Cliffs. Indicating that movement between the two populations occurs at least occasionally. Thus, a pneumonia outbreak in either could affect both populations.

There are no known large domestic sheep or goat operations in the range of the Lincoln Cliffs bighorns at this time. With increased residential development in the area there is potential for contact with domestic sheep or goats via 4-H and small-scale hobby farms, though none of these were identified during this reporting period. Additionally, information regarding the potential of disease interactions between domestic sheep and goats with bighorns was provided to the local 4-H extension for inclusion in the newsletter. Outreach to small farm operations, new residents, and local organizations should continue in order to minimize risk of outbreak. GPS collar data has allowed WDFW to better delineate the herd's home range and movements, and thus where to target education and outreach efforts regarding these threats.

Management Conclusions

The Lincoln Cliffs herd is estimated to be near the stated goal of 100-120 animals for this population if lambs are included. Given the expansion of this herd to Whitestone Rock, regular use of Sterling Valley, and the addition of GPS marked individuals, available habitat should be reviewed for this herd. Lincoln Cliffs sheep are living primarily on private land, both in the residential area of Lincoln and the agricultural fields above Whitestone. As Lincoln continues to be split into smaller parcels and developed, and the sheep consume agricultural crops, there is an increasing need to explore tools to address damage.

In early 2016, WDFW staff held a public meeting in Lincoln to update residents on current management and listen to concerns and ideas regarding future management of this herd. Outreach to residents and local producers should continue as management decisions are considered. Addition of a limited ewe hunt was proposed to the public as part of the 2018-2020 hunting season setting process. The proposal was supported, and two ewe permits were issued for the 2018 season, one in the Lincoln subherd and one in the Whitestone subherd.

Table 1. Lincoln cliffs herd lamb ratios. *2014-2018 data are from fall aerial survey, prior to 2014 data are from spring aerial survey.

Year	Ewes	Lambs	Lambs: 100 Ewe	Lower 90% CI	Upper 90% CI
2009	33	11	33	14	52
2010	37	16	43	22	64
2011	34	11	32	14	50
2012	37	12	32	14	50
2013	34	18	53	28	78
2014*	49	7	14	5	23
2015*	39	24	62	36	88
2016*	47	31	66	41	91
2017*	48	22	46	27	65
2018*	49	19	20	22	56

Table 2. Lincoln cliffs herd ram ratios from fall aerial surveys.

Year	Ewes	Rams	Rams:100 Ewe	Lower 90% CI	Upper 90% CI
2009	31	18	58	30	86
2010	41	16	39	20	58
2011	42	26	62	37	87
2012	49	21	43	25	61
2013	55	32	58	37	79
2014	49	38	78	50	106
2015	39	29	74	44	104
2016	47	29	62	38	86
2017	48	25	52	31	73
2018	49	20	41	23	59

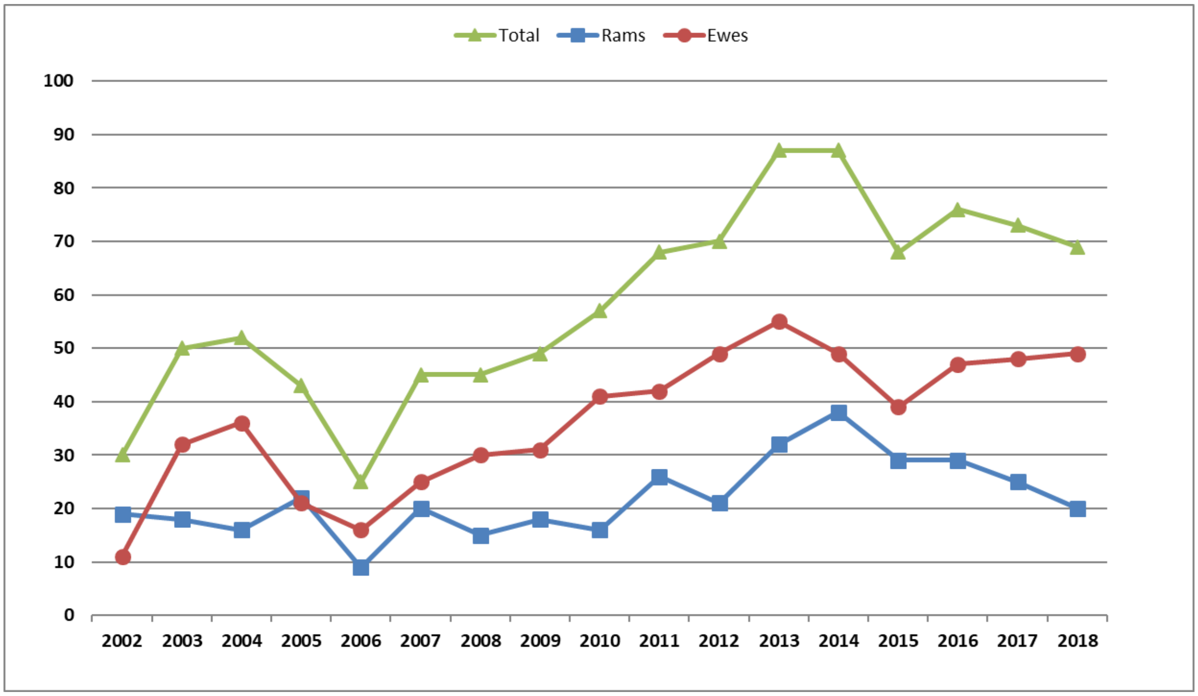

Figure 1. Lincoln Cliffs minimum population estimate by sex for 2002-2018. Shown are the maximum count from all helicopter surveys conducted each year, beginning in 2002, the year regular helicopter surveys were initiated.

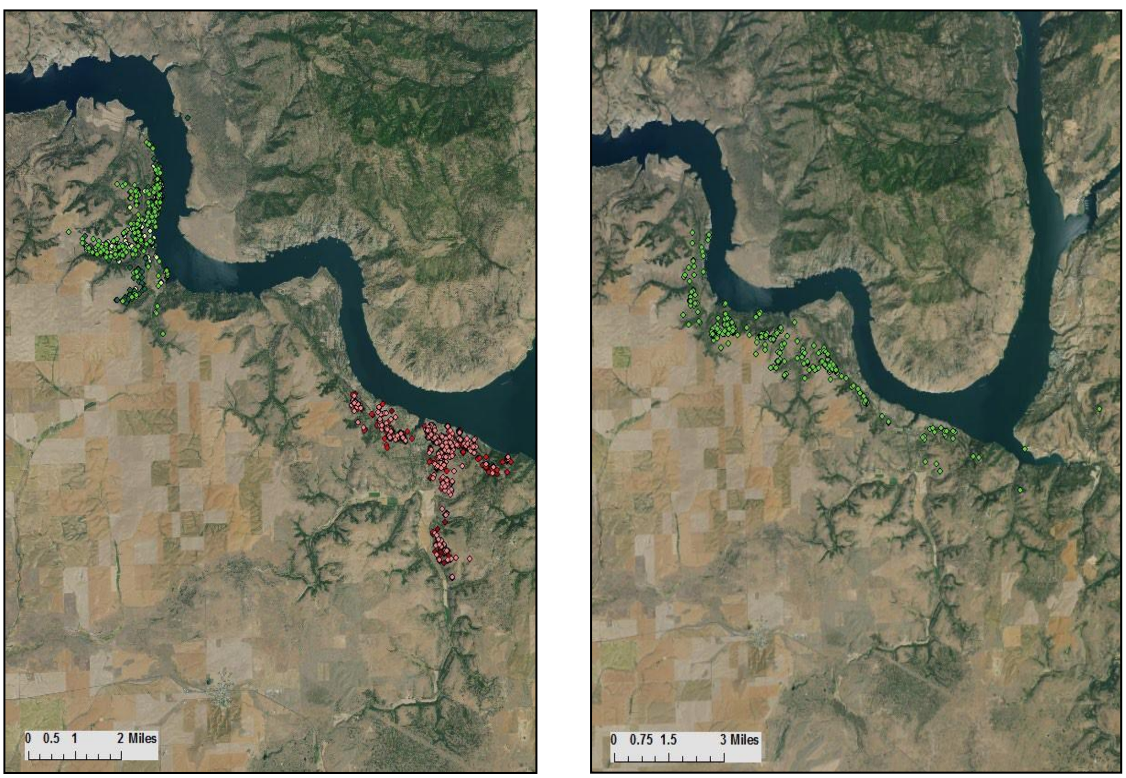

Figure 2. Left-hand panel: Radio locations for 6 Lincoln Cliffs bighorn ewes August 2016-July 2017. Whitestone ewes (3) are in green; Lincoln ewes (3) are in red. Right-hand panel: Radio locations for Whitestone ram August 2016-July 2017 in green.

Bighorn Sheep Status and Trend Report: Region 2

Mt. Hull and Sinlahekin

SCOTT FITKIN, Wildlife Biologist
JEFF HEINLEN, Wildlife Biologist

Management Guidelines and Objectives

Mt. Hull Herd

The objective for the Mt. Hull herd is to manage bighorn sheep numbers for a self-sustaining population capable of supporting both consumptive and non-consumptive recreation, while remaining within the capability of the limited land base to support it. The short-term objective for the Mt. Hull herd is to maintain a population size of 80-100 (http://wdfw.wa.gov/conservation/game/). Currently, the estimated herd size is within this level. The current management focus is to maintain the current population level while minimizing the risk of disease and agricultural damage. This population supports a conservative, any ram and adult ewe permit harvest to the extent it is compatible with herd demographics.

Sinlahekin Herd

The objective for the Sinlahekin herd is to manage bighorn sheep numbers for a self-sustaining population capable of supporting both consumptive and non-consumptive recreation. The short-term objective for the Sinlahekin herd is to attain a population size of 50-80 (http://wdfw.wa.gov/conservation/game/). Long-term, we estimate that the Sinlahekin sheep habitat could support 100 to 150 animals. The population reached a high in 2011 at an estimated 90-95 animals. In 2012, surveys indicated the population declined by as much as two-thirds but has been slowly recovering since. Most recent surveys estimate the herd size at 65-70 animals. The 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 the population size and reestablish harvest permits.

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

Year	WDFW Permits	WDFW Harvest	CCT[a] Permits	CCT Harvest
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 * 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
2015	1 ram 2 ewe	1 ram 1 ewe	4 any 2 ewe	3 ram 0 ewe
2016	1 ram 2 ewe	0 ram 1 ewe	1 any 2 ewe	1 ram *ewe
2017	1 ram 2 ewe	1 ram 2 ewe	1 any 2 ewe	1 ram 0* ewe
2018	1 ram 2 ewe	0 ram 1 ewe	1 any 2 ewe	0* ram 0* ewe

[a] CCT=Colville Confederated Tribes

* Not Reported

Population 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 all sheep in each herd. Although a complete count is generally not achieved, the majority of animals are typically documented by observers. This result represents a minimum count from which a population estimate is generated.

Mt. Hull Herd

WDFW biologists conducted a ground survey of the Mt. Hull Unit in 2019 classifying 70 sheep. Observed lamb recruitment was 26 lambs per 100 ewes. Ram recruitment was 40 rams per 100 ewes.

Sinlahekin Herd

WDFW biologists conducted a ground survey of the Sinlahekin Unit in December 2015 classifying 63 sheep, including 11 rams and 11 lambs. This yielded a lamb:ewe ratio of 27:100 (Table 3). Survey attempts in 2018 failed to produce adequate sample sizes.

Hunting Seasons and Recreational Harvest

Mt. Hull Herd

Permit harvest was closed in 2000 due to wildfire burning a substantial portion of the sheep range. Permit harvest resumed in 2003 with permit numbers varying over time with herd size and ram demographics. Beginning in 2009, ewe permits were offered to help achieve herd reduction goals. Permits are split between the Washington Department of Fish and Wildlife (WDFW) and the Colville Confederated Tribe (CCT). Table 1 shows permit levels and harvest success during 2000-2018. In 2018, WDFW and CCT permits remained at 1 ram and 2 ewes.

Sinlahekin Herd

In past years, herd demographics supported the issuance of one ram permit annually from 2010 through 2012, and hunters successfully filled all three permits. Since then herd demographics have not met management guidelines for harvest. If herd demographics improve and meet management guidelines opportunities for harvest will again be considered.

Survival and Mortality

Mt. Hull Herd

Observational data suggests that the Mt. Hull herd grew 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 at least through 2014, 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.

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						
Year	Lambs	Ewes	<3/4	≥3/4	Total	Unknown	Count Total	Population Estimate	L:100:R
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
2015	--	--	--	--	--	--	--	--	--
2016	--	--	--	--	--	--	--	--	--
2017	13	48	5	2	7	4	72	80-90	27:100:15
2018	6	26	8	6	14	0	46	--	1.02840278
2019	11	42	15	2	17	0	70	70-80	26:100:40

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. 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.

In February 2019, *Mycoplasma ovipneumoniae* (M. ovi) was discovered in a dead ram within the Mt. Hull herd. M. ovi is the bacterium that triggers pneumonia outbreaks in wild sheep herds. Five sheep (four rams and one ewe) were sampled, with all results positive for the M. ovi. However, continued monitoring has not documented an extensive die off to date. WDFW and the CCT had each issued one ram and two ewe permits for this herd but have now removed all permits due to this disease outbreak.

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.

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 timber harvest and prescribed fire as sheep habitat enhancement tools in the Sinlahekin Wildlife Area. The thesis by Tiffany Baker, entitled “Habitat Selection and Spatial Responses of Bighorn Sheep to Forest Canopy in North-Central Washington” was completed and successfully defended in 2015.

During the 2011 research capture effort, Psoroptic mange was discovered in the Sinlahekin 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. In 2016 and 2017, six bighorn sheep mortalities were documented. Investigations could not determine cause of death. However, predation was ruled out and nasal swabs to detect pneumonia were negative. No mortalities were documented in 2018Eight of these sheep captured in 2014 were fitted with GPS radio collars to increase survey accuracy. The apparent increase in the Sinlahekin population, based on the count obtained in 2015, was much too dramatic to have been caused by reduction in lamb recruitment. More likely, shifts in herd range use during the 2012-2014 period caused the large variation in annual counts. Also, possible, although less likely, is that groups of animals emigrated, and then they or other sheep later immigrated to the Sinlahekin herd. Movements among bighorn herds in the Okanogan Valley and environs are not uncommon (see below).

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	<3/4	>3/4	Total	Unknown	Count Total	Population Estimate	L:100:R
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	0.69488426
2006	3	24	2	3	5	0	32	35-40	0.5696875
2007	2	37	5	7	12	0	51	50-60	0.69481481
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	0.36159722
2012	2	15	2	0	9	0	26	30-35	13:100:60
2013	4	29	3	2	5	0	38	40-45	0.65297454
2014	7	16	2	2	4	0	27	30-35	44:100:25
2015	11	41	8	3	11	0	63	65-70	27:100:27
2016	--	--	--	--	--	--	--	--	--
2017	3	7	6	1	7	5	22	--	0.94502315
2018	--	--	--	--	--	--	--	--	--

Habitat

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. 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.

In 2017, the US Forest Service Tonasket Ranger District initiated an analysis of the Mt. Hull herd's habitat conditions within the District's boundaries. Potential management actions being analyzed include conducting prescribed fire, weed control, and other efforts to benefit bighorn sheep habitat. On the ground implementation is anticipated to begin in 2020.

Radio collar data indicates that the current landscape supports functional connectivity between the Mt. Hull herd and the bighorn sheep herd at Omak Lake to the south and the Vaseux Lake herd in British Columbia, Canada, and to the north. Radio collared sheep from both the Omak Lake and the Vaseux Lake herds have traveled into the Mt. Hull herd (2010 and 2016 respectively) and then returned to their original herds. DNA testing of the Omak Lake herd indicated all animals tested but one is 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, approximately 2,500 acres within the Sinlahekin Wildlife Area has been treated with prescribed fire. Of that, approximately 1,260 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. In addition, the 2015 Okanogan Complex fire burned 7,000 acres within the Sinlahekin Wildlife Area. Many of these acres are within the southern end of the Sinlahekin herd's range. An aggressive weed control program, in addition to the thinning and burning efforts, 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,* the bacterial pathogen associated with bighorn die-offs. WDFW biologists have been working to encourage holders of small herds of sheep and goats to minimize risk to bighorns.

Management Conclusions

Mt. Hull Herd

Reducing/eliminating the risk of contact between domestics and bighorns, improving range conditions, reducing agricultural damage and road kills are all needed for the viability and health of the Mt Hull herd. Domestic sheep and goats are in close proximity to the Mt. Hull bighorns. Having these domestic herds be M. ovi free would reduce the risk of disease transmission. The proposed range improvements on USFS lands should reinvigorate range quality. WDFW supports these efforts and continues to work on improving habitat and reducing the factors associated with vehicle collisions and agricultural damage.

Sinlahekin

The herd appears to be recovering from the precipitous decline earlier in the decade either from immigration, improved productivity, or a combination of both. Extensive prescribed fire and thinning treatments in association with weed control strategies are producing improved habitat on the Sinlahekin Wildlife Area. Maintaining separation between bighorn sheep and domestic sheep and goats is a current management priority.

Bighorn Sheep Status and Trend Report: Region 2

Swakane, Chelan Butte, Manson

DEVON COMSTOCK, Wildlife Biologist

Management Guidelines and Objectives

Three herds of 'California' bighorn sheep are found in Chelan County. The Swakane herd was established in 1969 with the translocation of nine bighorn sheep from the Colockum herd (which, in turn, were descended from animals brought from near Williams Lake, British Columbia). Between 1999-2001, 47 sheep from multiple Washington herds and 21 sheep from British Columbia were reintroduced to the north shore of Lake Chelan to establish the Manson herd, and most recently, in 2004, 35 bighorn sheep from the Cleman herd were reintroduced to establish the Chelan Butte herd. In addition, bighorn sheep from the Quilomene herd use areas in Chelan County by 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 from domestic sheep grazing allotments on public land, and provide information to the public about the importance of separating wild and domestic sheep; reintroduce bighorn sheep into suitable unoccupied historic habitat within the District; and (5) provide recreational opportunities.

The short-term objective for the Swakane herd is to maintain a population size of 130-170 animals; long-term, we estimate the habitat can support 150-180 animals (WDFW 2014). The short-term objective for the Manson herd is 100-120 sheep, while the long-term objective estimates that the available habitat could support up to 200 sheep. The Chelan Butte herd has expanded from an original release of 35 in 2004, to a current estimate of roughly 200 bighorns. Although habitat analysis (Musser and Dauer 2003) suggests sufficient habitat exists for a population of 195-390 sheep in the area currently occupied by the Chelan Butte herd, concerns regarding possible movement of animals out of their core range into areas where they may encounter domestic sheep or goats have led WDFW to propose an objective of 150-170 bighorns (WDFW 2014).

Population Surveys

Prior to 2009, herd population data were 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). All three herds were surveyed in 2009 and uncorrected minimum counts were produced. In March of 2009, 12 sheep were outfitted with telemetry collars in both the Swakane and Manson 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. These collars 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 bighorns were outfitted with GPS telemetry collars in the Manson herd to continue monitoring efforts. Typically, 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. Minimum population counts are produced from high counts based on sex/age composition. In 2018, the Manson herd was surveyed by helicopter in November by WDFW personnel, and the Chelan PUD conducted seven surveys by boat over the 2018/19 winter (Pope & Cordell 2019). In fall 2018, ground counts were conducted during the rutting period to obtain minimum counts and ratio estimates for the Chelan Butte and Swakane herds. Ground counts for both the Swakane and Chelan Butte herds follow vehicle-accessible routes along public highways, county roads, and unimproved roads. However, due to topographic relief and the limits of optics, these ground counts certainly underestimate herd sizes. Due to limitations in available personnel, spring lamb counts have not been conducted over the last two years. WDFW is planning to conduct comprehensive aerial surveys of both the Chelan Butte and Swakane herds in 2019.

Hunting Seasons and Recreational Harvest

In 1999, the first ram permit was offered for the Swakane herd, followed by one permit per year from 2000-2015, increasing to 2 in 2016. Additional Swakane harvests occurred in 2009 and 2016 by statewide auction tag winners (Table 4). Currently, the bighorn season in the Swakane runs September 15-October 10. In 2018, the Yakama Nation offered two ram tags for the Swakane herd. All 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 significantly reduced 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.

Two permits have been offered in the Manson unit since the hunt began in 2005. Both auction tag holders and raffle tag holders regularly harvest rams from the Manson herd. There will be two drawing permits offered for the Manson herd along the north shore of Lake Chelan for 2019.

The Chelan Butte herd was hunted for the first time in 2010, with hunters harvesting mature rams in each year since. Aerial and ground surveys of the area have confirmed an increasing herd. A second drawing permit for hunters with disability was offered in 2015. WDFW is offering four adult ram tags as well as four ewe permits in 2019. Hunters with disabilities will also have the opportunity to be drawn for 5 permits, three for bighorn ewes, and two for juvenile rams. Raffle tag winners often harvest additional rams from Chelan Butte.

Survival and Mortality

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 increased use of the cliffs and 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, the number of bighorn sheep being killed by vehicles rose steadily with numerous sheep being killed on Hwy 97A. 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. This wildlife fence spans nine miles, starting at milepost 203 and extending to milepost 212. Prior to being fenced this stretch of highway was identified as having some of the highest vehicle strikes in the state. While vehicle collisions have not stopped, collision rates for bighorn sheep have dropped significantly, with only two vehicle collisions being encountered during the 2018/19 reporting period (WSDOT unpublished data).

Data collected during focused ground surveys has increased minimum counts. From 2011 through 2014, Swakane herd counts increased steadily. Ground counts for bighorns exhibit significant variability because of the inherent bias in sightability and accurately classifying animals. Year to year variation in the distribution of bighorns and survey effort insert significant variability into minimum counts and populations estimates. When surveys return a reduced number of observations, and no other supporting data suggesting populations declines, the previous year's count may continue to be the best estimate. In 2017 a multi-day ground survey effort returned a minimum count of 150 animals for the Swakane herd. More robust and consistent survey effort is needed to determine if this herd is meeting short-term population objectives set forth in the 2015-2021 Game Management Plan (WDFW 2015).

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. Locations from telemetry data show that several bands have centralized their core use area westward up lake into steeper, rockier, habitat. Compared to the other two 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 2014 survey returned an observation of 113 sheep, matching 2009. The collars allowed for a productive aerial survey, where we documented the herd's highest observed count (Table 2). In 2018 limited fall aerial surveys returned a count of 72 sheep with a lamb:ewe ratio of 26:100. These counts were similar to spring aerial surveys conducted in 2017. While the Chelan PUD recorded a higher minimum count of 96 bighorn sheep during their winter surveys on Lake Chelan that same year, with an estimated lamb ratio of 15.3 (Pope and Cordell 2018). The low number may have been the result of sheep being distributed differently than was anticipated for the survey.

The Chelan Butte herd has shown rapid growth and is now expanding their range north of Chelan Butte into Deer Mountain and Howard Flats. Recent observations of bighorns south of Knapp Coulee suggest that expansion is continuing to occur. An aerial survey of this herd was conducted 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 207 in 2017 (Table 3). The majority of herd counts occur on the main portion of the herd on the Chelan Butte Wildlife Area Unit, so an estimate of two hundred plus sheep represents a minimum.

The connectivity of the Chelan Butte herd to the other two herds is not understood, though it is apparent this herd is expanding both north and south of its core range. Multiple sightings of bighorn sheep at low elevations in the Entiat Valley have occurred, though it cannot be determined with certainty which herd these animals may have originated from. In recent years, sheep from the Swakane herd have been detected almost to the mouth of the Entiat River.

We estimate that roughly 20 bighorns seasonally use the Colockum and Jumpoff Ridge areas in Chelan County. These sheep are considered part of the Quilomene herd. A group of 10-15 rams are regularly seen east and 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. Due to the consistent use of these areas by the Quilomene herd, the boundary of the hunt unit was extended northward to include those sheep, allowing hunters to pursue them where possible.

Habitat

Both the Chelan Butte and Swakane herds occupy low elevation sites characterized primarily by Columbia Basin grasslands and shrub-steppe habitats. These areas are dominated by bluebunch wheatgrass and big sagebrush, transitioning to arid ponderosa pine and Douglas fir forests at higher elevations. The current habitat conditions for these two herds is driven by historic land uses, the current fire regime, and the success of active habitat restoration. Although fires can be beneficial to bighorn sheep by reducing conifer encroachment and increasing the forage quality of perennial grasses and forbs, fire regimes have been altered in modern times due to fire suppression, silvicultural and grazing practices, and increased human-caused ignitions. In general, the lower elevation shrub-steppe and grassland habitat fires are increasing in frequency and are primarily human caused. As a result, vegetation communities are being altered by reduction of the shrub component and increased invasive annual grasses and weeds. This has been the scenario in the range of the Swakane herd, with successive human caused fires in 2007, 2009, 2010, and again in 2014, which cumulatively burned 48,600 acres. In 2015, the Chelan Complex fire burned through steep canyon habitats within the northern range of the Chelan Butte herd, including an area known for holding bighorn sheep groups.

WDFW manages both the Chelan Butte and Swakane Units of the Chelan Butte Wildlife Area and has implemented active restoration projects to restore previously farmed dryland agricultural fields back to native perennial grass and shrub communities. Over the past 8 years, the Department has been successful in transforming 27 fields on Chelan Butte to native habitat with grasses, forbs, and shrubs. By the end of 2017, all the fields had been seeded with native grass. Restoration of the fields has provided visible benefits to Chelan Butte's bighorn sheep herd. The agriculture field restoration on Chelan Butte is expected to be completed by 2022.

The Manson herd on the north shore of Lake Chelan occupies somewhat different habitat types spanning a range of ecotypes, from cool season grasslands and shrub-steppe, to ponderosa and lodgepole pine forests mixed with true firs. Habitat conditions here are generally excellent, with wildfires providing disturbance to maintain high quality herbaceous forage. 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. In 2013, the 2,100 acre 25-Mile fire reburned a section of the Deer Point Fire. During the winter, boat surveys show the majority of bighorn sheep are concentrated between Mitchell Creek and Grade Creek (Pope & Cordell 2019).

The Manson herd occurs almost entirely on land managed by the USFS, with a few private lake front properties at the southeastern end of their range. Their occupied terrain is extremely rugged and remote with few roads. Unlike the Chelan Butte and Swakane herds, the Manson herd is not realistically threatened by development and land use conversion. However, the continued development of the community of Manson and the development of desirable parcels in the unincorporated areas north and east of the City of Chelan may present connectivity barriers for exchange between the Manson and Chelan Butte herds.

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 small amount of habitat, as they have always spent most of their time in habitats west of the highway. While developed springs are likely used by sheep, their presence is not thought to be critical to the herd.

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. Those same areas are actively being developed, and the ornamental vegetation associated with houses was thought to be an attractant, drawing sheep onto and across the highway where they suffered multiple vehicle collisions. Maintaining habitat connectivity at lower elevations is a priority for managing Chelan County’s bighorn sheep herds. Between 2000 and 2015 Chelan County saw significant population growth with the addition of over 5,500 residences. Most development occurs below 2,000 ft. on slopes less than 20%. From 2017 to 2037 the unincorporated population of Chelan County is expected to grow by 3,751 people, requiring an additional 1,405 residences (Chelan County 2017).

Human-Wildlife Interaction

Few official reports of agricultural damage attributed to bighorns were received in 2017. However, reports have been received in recent years from orchardists in the Swakane and Chelan Butte about the presence of bighorns in their orchards. They have expressed concerns of damage to young trees; yet no claims for damage have been filed. Observations indicate that the sheep are feeding mainly on grass within the irrigated orchards but will feed on orchard trees. New plantings suffer the greatest damage from bighorn when this occurs. In an effort to reduce occurrences of bighorns feeding in orchards, old fences on the Chelan Butte Wildlife Area have been replaced and or upgraded.

The public lands on which these bighorn sheep herds range are increasingly attracting new types, and previously unanticipated levels of recreation that may have a negative impact on bighorn sheep. This is especially true for the Chelan Butte and Swakane herds, which occupy land that is adjacent to a highly traveled interstate highway and contains numerous maintained and unmaintained roads and trails. Both mountain biking and cross-country hiking are popular activities in the Swakane Canyon and Chelan Butte areas. The creation and use of unauthorized trails on public lands creates wildlife disturbance, soil erosion and vectors for noxious weeds. In 2017, WDFW received a proposal to establish a multi-use recreational trail on the Chelan Wildlife Area, which could potentially disrupt bighorn sheep in the area. Research conducted in other parts of the U.S. and Canada indicate that sheep exhibit a stress response to approaching humans, especially those with dogs (MacArthur et al. 1982), and can be displaced by or alter feeding habits in response to non-motorized recreation (Lowrey and Longshore 2017, Wiedmann and Bleich 2014). Discussions are under way both within WDFW and with user groups to craft solutions that meet the management objectives of the wildlife area.

Due to their high visibility both the Swakane and Chelan Butte sheep herds offer excellent wildlife viewing opportunities. Because these herds do not make long distance seasonal migrations, it is possible to view rams, ewes, and lambs throughout the year. The famous horn clashing battles of bighorn rams are on display each fall. With persistent searching, it is not unreasonable to expect to see 50 to 100 bighorns during the peak of the breeding season. The lack of safe pullouts along SR 97A near fall sheep congregation can sometimes create traffic hazards.

Population Augmentation

There have been no bighorn sheep population augmentations in Chelan County since 2004, and no plans to translocate bighorns in the immediate future. In winter 2019, WDFW captured thirty bighorn sheep from the Chelan Butte herd. All animals were tested for pathogens, including *Mycoplasma ovipneumoniae,* for which they all tested negative. Twenty animals were translocated to the Stansbury Mountains in Utah, in order to augment a newly re-established herd.

Research

No formal research is currently being conducted on any bighorn sheep herds in Chelan County. In winter 2019 ten bighorn sheep from the Chelan Butte herd were outfitted with GPS-enabled collars and released on site. Eight adult ewes and two juvenile rams received collars. Collar data will provide information on seasonal habitat use, survivorship and help guide survey efforts. Additional deployment of collars will be planned as resources allow.

Management Conclusions

The risk of disease transmission from domestic sheep is substantial for both the Swakane and Chelan Butte herds (Lyons et al. 2016). 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 at the greatest risk for disease transmission from domestic animals. In both 2013 and 2014, four bighorn ewes were seen multiple times near and within occupied domestic grazing allotments in the Entiat Valley. Efforts to locate and remove the bighorn sheep were unsuccessful. In spring 2019, USFS personnel and local citizens reported sighting up to five bighorn ewes crossing the Entiat River at Ardenvoir towards occupied sheep grazing allotments. Both USFS and the producer responded immediately by moving domestic sheep off pastures earlier than planned. WDFW continues to work closely with the USFS to minimize encounters between bighorn and domestic sheep.

Also, of concern are small unregistered hobby farms where domestic goats or sheep may be raised in pastures adjacent to bighorn sheep ranges. To the extent possible local WDFW staff works to identify and educate local landowners about the risks of disease transmission from domestic livestock to bighorn 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 continue to be conservative to maintain viewing opportunities.

As the population of Chelan County grows and the demand for year-round recreational opportunities on public lands increases, managers will have to evaluate and make difficult decisions regarding impacts to sensitive wildlife populations, such as bighorn sheep. Opportunities to engage in land use planning at federal, state, and local levels should be a priority to secure bighorn sheep populations into the future.

The population objective of 150 sheep for the Manson herd on the north shore of Lake Chelan 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. Recent WDFW minimum counts have been lower than expected. This may be due to a change in habitat use by bighorn sheep, due to the terrain ruggedness that results in reduced visibility, or from a yet undiscovered source of additional mortality. Future aerial surveys should include previously Unsurveyed potential habitat to evaluate whether the Manson herd has shifted its range or is more broadly dispersed than previously thought. Of all the herds in Chelan County, developing a more precise abundance estimate for the Manson herd would be of the greatest benefit.

Literature Cited

Chelan County. 2017. Chelan County Comprehensive Plan 2017-2037. 284 p.

Lowrey, C. & Longshore, K.M. 2017. Tolerance to disturbance regulated by attractiveness of resources: A case study of Desert bighorn sheep within the River Mountains, Nevada. Western North American Naturalist. 77(1). 82-98 pp.

Lyons, A.L., Gaines, W.L., & Begley, J. 2016. Application of the Bighorn Sheep Risk of Contact Model on the Okanogan-Wenatchee National Forest, Final Report. Washington Conservation Science Institute. 49 p.

MacArthur, R.A., Geist, R. & Johnston, H. 1982. Cardiac and Behavioral Responses of Mountain Sheep to Human Disturbance. Journal of Wildlife Management. 46. 351-358.

Musser, J., and P. Dauer. 2003. Bighorn reintroduction site evaluation. USDI-BLM Wenatchee Resource Area. 14p. Washington Department of Wildlife. 2008. 2009-2015 Game Management Plan. Wildlife Program, WDFW, Olympia, Washington, USA.

Pope, V. R. and Cordell, K. A. 2019. Lake Chelan Annual Winter Wildlife Survey Report: Winter of 2018-2019. Chelan Public Utility District, Wenatchee WA.

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

Wiedmann, B.P. & Bleich, V.C. 2014. Demographic Responses of Bighorn Sheep to Recreational Activities. A Trial of a Trail. Wildlife Society Bulletin. 38(4). 773-782.

Table 1. Observed population composition of the Swakane bighorn sheep herd, 2009-2018.

Year	Lambs	Ewes	Yrl	<3/4curl	≥3/4 curl	Total rams	Total sheep	Lambs: 100 ewes	Rams: 100 ewes
2009	17	34	5	5	20	30	81	50	88
2010	17	44		13	13	26	87	39	59
2011	13	63		14	16	23	107	22	48
2012	24	58	4	17	19	40	122	41	67
2013	27	63		12	29	41	131	43	65
2014	31	62	6	17	23	46	139	50	74
2015	-	-	-	-	-	-	-	-	-
2016*	6	30	0	9	13	22	57	30	73
2017**	4	55	0	42	23	65	150	7	118
2018	37	35	0	22	16	38	110	106	109

* High counts from multiple surveys.
**2017 counts include unclassified sheep

Table 2. Observed population composition of the Manson bighorn sheep herd, 2009-2018.

Year	Lambs	Ewes	Yrl	<3/4 curl	≥3/4 curl	Total rams	Total sheep	Lambs: 100 ewes	Rams: 100 ewes
2009	11	59	5	7	26	43	113	19	73
2010	11	58		15	17	32	101	19	55
2011	10	51		6	21	25	86	20	49
2012	15	52	2	7	13	22	89	29	42
2013*	18	65		6	11	18	101	28	26
2014	23	66	6	7	11	24	113	35	38
2015	-	-	-	-	-	-	-	-	-
2016	7	49	0	7	2	9	65	14	18
2017**	5	24	0	25	5	30	77	21	125
2018**	10	38	1	10	8	23	72	26	60

* Spring 2013 count incomplete.
**counts include unclassified sheep
2017 ram:ewe ratio based on limited fall counts

Table 3. Observed population composition of the Chelan Butte bighorn sheep herd, 2009-2018.

Year	Lambs	Ewes	Yrl	<3/4 curl	≥3/4 curl	Total rams	Total sheep	Lambs: 100 ewes	Rams: 100 ewes
2008	10	32				21	63	31	66
2009	12	48	7	3	14	24	84	25	50
2010	16	50		17	18	35	101	32	70
2011	19	46		15	13	28	93	41	61
2012	13	72	8	10	25	43	128	18	58
2013	25	97		17	26	41	163	26	42
2014	34	97	9	11	32	52	183	35	54
2015	-	-	-	-	-	-	-	-	-
2016*	21	34	4	11	21	32	130	64	70
2017**	34	90	0	29	21	50	207	38	56
2018	23	67	0	18	7	25	116	34	37

* High counts from multiple surveys.
**counts include unclassified sheep

Table 4A: 10 Yr. Summary of Ram Harvest: Swakane

Year	Permits	Harvest	Comments
2008	1	1	
2009	0	0	**
2010	1	1	
2011	1	1	
2012	1	1	
2013	1	1	
2014	1	1	
2015	1	1	
2016	3	3	*
2017	2	2	
2018*	2	3	***
Total	**14**	**15**	

* Includes harvest by Auction tag holder.
** No tag offered due to excessive vehicle mortalities.
*** Tribal harvest unknown

Table 4B: 10-year Summary of Ram Harvest: Manson

Year	Permits	Harvest	Comments
2009	2	1	
2010	2	4	*
2011	2	4	*
2012	2	3	*
2013	2	3	*
2014	2	2	
2015	2	2	
2016	2	2	
2017	2	2	
2018	2	2	
Total	**20**	**25**	

* Includes harvest by Auction and/or Raffle tag holders.

Table 4C: 10-year Summary of Ram and Ewe Harvest: Chelan Butte

Year	Permits	Disabled Hunt Permits	Harvest	Comments
2010	1	-	1	
2011	1	-	1	
2012	1	-	1	
2013	1	-	1	
2014	1	-	1	
2015	4	3	5	*
2016	6	4	7	*
2017	6	4	5	
2018	13	5	15	*
Total	**34**	**16**	**37**	

* Includes harvest by Auction and/or Raffle tag holders.
* First ewe tags offered in 2015

Bighorn Sheep Status and Trend Report: Region 3

Quilomene, Cleman Mountain, Umtanum/Selah Butte, and Tieton

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Management Guidelines and Objectives

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, and wildlife viewing and photography.
3. Manage for sustained yield.
4. Numerical goals for each herd are provided in Tables 2-5.

Population Surveys

Historically, the Quilomene and Umtanum/Selah Butte bighorn herds had been surveyed via helicopter in July. The survey timing was not a good index to actual recruitment or optimal for detecting disease problems. In 2014, surveys were changed to March. Cleman Mountain sheep are surveyed at the feeding station in December/January.

Umtanum and Selah Butte bighorn sheep (which also go by the name "Yakima Canyon" bighorn sheep when reference is to both together) were surveyed from helicopter and the ground numerous times from late 2009 through 2016, due to a disease outbreak and research project. Ground surveys are conducted in August/September to index early lamb recruitment. Final recruitment surveys are done in February/March. In 2017-18, all surveys were done from the ground. All available information is used to estimate the total population. Survey results are shown in Tables 2-5.

Hunting Seasons and Recreational Harvest

Region 3 currently supports three populations of 'California' Bighorn Sheep: Cleman Mountain, Umtanum/Selah Butte, and Quilomene. The Tieton herd was removed in 2013 due to a severe pneumonia outbreak that put the adjacent Cleman Mountain herd at risk. Sheep hunting is by special permit. The number of permits (WDFW only) and harvest are given in Table 1. The Yakama Nation (YN) typically matches WDFW permits one to one for all sheep herds. The Muckleshoot Indian Tribe also issues permits for the Cleman Mountain and Umtanum/Selah Butte herds. YN does not report harvest, but their hunters are often encountered by the public/WDFW enforcement. When YN harvest is available to WDFW, it is included in Table 1.

In 2018, WDFW issued nine herd-specific ram permits, one raffle (any herd), and 20 Cleman Mountain ewe permits. A total of 11 rams and 13 ewes were known to be harvested (Table 1).

Survival and Mortality

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. Reintroduction 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 outbreak circa 2004- 2006. Adult ewe counts had been declining and reached lows in 2014. In 2013, a large, fast- moving fire went through the northern portion of the herd area. Following the fire, sheep were difficult to find. This was apparently due to a shift in range, as numbers rebounded to expected levels in 2015. Lamb recruitment has been fairly low, and the population was below objective. The herd was augmented with 8 ewes, 7 lambs, and 6 rams obtained from the Cleman Mountain herd in January 2017. This augmentation increased Quilomene sheep to near objectives, as survival has been high for the translocated sheep.

The Cleman Mountain population was established in 1967 with the release of eight animals. The herd remained relatively stable 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 150 animals by 2000 (Table 2). Over 165 sheep have been captured and translocated elsewhere from this herd since 2001. Another 150 sheep have been harvested during that period, and the population is still above objective. The Cleman Mountain herd continues to produce a large number of lambs and continues to grow. The Cleman herd is at high risk of contracting bacteria associated with pneumonia outbreaks due to nearby domestic sheep grazing allotments. Concerns have led to frequent testing; the most recent testing was in January 2017. No evidence of pneumonia or associated bacteria was detected. There are currently no herds managed by WDFW that are appropriate for augmentation. Ewe permits are being issued in hopes of limiting growth.

The Umtanum herd was established in 1970 with the release of eight 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 that animals cross the river in both directions, and it is now considered a single herd (termed the Yakima Canyon herd). In 2001, 11 sheep were released at the south end of the canyon near Roza Dam.

Population estimates for Umtanum/Selah Butte (aka Yakima Canyon) varied between 170 and 200 animals until 2002. Dispersal, winter mortality, and the removal of 52 sheep for augmenting other populations probably kept the numbers stable. The increase, after 2002, was largely due to the release of 11 animals and a subsequent increase in lamb production. Harvest was 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 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. However, testing of 31 animals in February 2013 found *Mycoplasma*

ovipneumoniae (*M. ovi*) in one young ram. Adult survival has been high since 2013, but lamb recruitment was low from 2013 through 2017. Samples were collected from sheep on both sides of the river. Pneumonia was confirmed, as was the same strain of *M. ovi* that evidently entered the population in 2010. Bernatowicz et al. (2016) provides a full accounting of the experience with pneumonia in the Umtanum/Selah herds (available at http://media.nwsgc.org/proceedings/NWSGC-2016/Bernatowicz_NWSGC20_38-61.pdf).
In early fall 2015, there was also an apparent outbreak of bluetongue virus. Two ram carcasses tested positive, as did one road-killed ewe.

There has been evidence of cougars hunting sheep on the Umtanum side of the river. Counts on the Umtanum side have been lower than expected and the sheep more difficult to find as their habits have changed. Umtanum sheep also produce few lambs (probably *M. ovi* related) and the herd is declining. Lamb production on the Selah Butte side of the river has been better, but sub-herd specific. Selah south has regularly produced lambs, but the majority have been ram lambs. The Mount Baldy sub-herd rarely produced lambs in recent years until 2018. In late winter 2018, a Mount Baldy ewe has hit on the highway and was shedding *M. ovi*. Nearly every ewe lamb survived in the sub-herd during 2018 and 2019. It is possible that the one carrier was removed via vehicle from the sub-population.

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 during 2009-2012. During the captures, 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 healthy Cleman Mountain herd. A total of 57 bighorns were euthanized. Pneumonia and *M. ovi* were confirmed in all samples. The strain of *M. ovi* in the Tieton herd was different from that found in the Yakima River Canyon (Umtanum) sheep.

Habitat

Forage resources vary annually with moisture. Precipitation had been near or above average 2010-2012, undoubtedly increasing forage production. Drought conditions returned in 2013-2016. A significant portion of the north Quilomene range burned in 2013. The impact of that fire is unclear. In forested areas, fires can decrease cover and increase browse. In more arid climates, fires can reduce plant diversity. Moisture was high in fall of 2016 through spring 2018, increasing total forage for all herbivores. Late winter moisture in 2018-19 was again higher than average.

Population Augmentation

The Quilomene herd received 21 sheep from the Cleman Mountain herd in January 2017. This augmentation was more driven by opportunity than necessity. The Cleman herd has been over objective and easy to trap at the winter feed site. There was also a desire to learn more about Quilomene sheep via GPS collar data.

No habitat enhancement projects have been funded for bighorn sheep in the region. In general, bighorn habitat is difficult to manipulate, and success of any habitat projects would be limited due to shallow soils and arid conditions. Sheep at Cleman Mountain are fed during the winter, mostly to make periodic trapping easier.

The most beneficial projects to bighorn populations would be to reduce/eliminate contact risk 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 in the region is bacterial pneumonia caused by contact with domestic sheep/goats. The Tieton herd was eliminated, and current plans call for delaying reintroduction until the risk of contact with domestic sheep or goats is substantially reduced. The Yakima Canyon herd initially rebounded from die-off during winter 2009-10, but currently suffers from low lamb recruitment most years and is decreasing slowly. The low recruitment also means a population that has more old than young animals. The expectation is that there are few animals carrying ("shedding") *M. ovi*. The accidental removal of the shedder from Mt. Baldy demonstrates the potential for the herd to recover. It is not economically/logistically feasible to test 200 sheep and cull the few *M. ovi* shedders. The population is currently being reduced using public hunting, with samples being collected from each sub-herd. If sub-herds such as Mt. Baldy prove to be *M. ovi* free, captures will not be needed. If a management action such as "Test and Cull" were to be done in the Yakima Canyon herd, it should be done soon while the herd still has productive breeding-age ewes.

Disease outbreaks are not unexpected because 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 likely essential to the long-term viability and health of bighorns. It may be possible to develop *M. ovi*-free animals in small-sized domestic herds grazed on private lands. This would reduce the risk of pneumonia. For some herds (e.g., Tieton), the larger risk comes from domestic sheep grazing on public (USFS) land allotments.

Literature Cited

Bernatowicz, J., D. Bruning, E. F. Cassirer, R. B. Harris, K. Mansfield, and P. Wik. 2016. Management responses to pneumonia outbreaks in three Washington state bighorn herds: lessons learned and questions yet unanswered. Biennial Symposium of the Northern Wild Sheep and Goat Council 20: 38-61.

Table 1. Summary of bighorn sheep ram harvest in Region 3 since 2008.

Area	Year	Permits	Harvest	Comments
Cleman Mountain	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
	2015	6	6	Harvest includes tribal
	2016	6 Ram,10 Ewe	8 Ram,11 Ewe	Harvest includes tribal
	2017	3 Ram. 10 ewe	5 Ram, 7 ewe	Harvest includes tribal
	2018	3 Ram,20 ewe	3 Ram, 13 ewe	
Umtanum/Selah Butte	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
	2015	5	8	Harvest includes raffle hunter, tribal
	2016	4	8	Harvest includes raffle hunter, tribal
	2017	4	8	Harvest includes raffle hunter, tribal
	2018	4	5	Harvest includes tribal
Quilomene	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	
	2015	2	2	
	2016	2	2	
	2017	2	3	Harvest includes tribal
	2018	2	3	Harvest includes raffle hunter

Table 2. Quilomene Population Composition.

Year	Lambs	Ewes	Total Rams	Adult Rams	Total Count	Estimated Population	Short-term Objective
2007	44	75	32	26	151	160	
2008	33	77	14	11	124	160	
2009	27	86	32	23	145	160	
2010	25	57	20	14	102	160	
2011	11	48	15	15	74	150	
2012	41	65	43	37	149	160	
2014	18	34	28	20	83	100	
2015	20	93	47	44	160	160	
2016	17	73	72	54	162	170	
2017	No	Survey					
2018	23	95	69	58	187	190	200

Table 3. Cleman Mt. Population Composition.

Year	Lambs	Ewes	Total Rams	Adult Rams	Total Count	Estimated	Short-term Objective
2008	40	85	64	40		174	
2009	30	98	70	45		198	
2010	35	83	60	48	201	201	
2011	34	83	88	65	205	205	
2012	30	78	59	59	167	180	
2013	45	101	60	50	206	210	
2014						235	
2015	50	129	80	60	259	260	
2016	30	145	40	30	215	215	
2017	42	152	46	35	240	250	170-220
2018	45	145	55	40	245	250	170-220

Table 4. Umtanum/Selah Butte Population Composition.

Year	Lambs	Ewes	Total Rams	Adult Rams	Total Count	Estimated	Short-term Objective
2007	54	120	68	55	242	300	
2008	63	156	60	51	*279	300	
2009	47	149	62	52	257	300	
2010	23	90	63	60	176	210	
2011	33	109	53	50	195	220	
2012	65	155	68	57	*288	270	
2013	42	80	13		135	270	
2014	14	168	85	58	267	270	
2015	13	168	57	49	238	265	
2016	33	144	30	26	233	260	
2017	11	160	46	40	217	240	
2018	11	121	31	26	152	230	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	Long-term Potential
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	250
2006	35	55	40	37	130	135	250
2007	23	63	7	0	93	160	250
2008	54	81	32	16	167	200	250
2009						200	250
2010	40	72	89	48		200	250
2012	33	66	24	16	125	150	250
2013	Herd	Eliminated					250

Moose

Moose Status and Trend Report

STATEWIDE

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Introduction

Moose (*Alces alces*) apparently migrated on their own accord into eastern Pend Oreille County, Washington in the 1950s. The first official state documentation of moose in Washington occurred in 1954 (Poelker 1972), although the literature reports a bull moose that was taken by hunting on the Colville Indian Reservation in 1929 (Scheffer and Dalquest 1944). In the decades since, moose have increased both in numbers and distribution. They are now common in northeast Washington, can be found in smaller populations in the Okanogan and Blue Mountains, and a few scattered individuals have colonized the east slopes of the Cascades. Moose have been documented to wander into many other places throughout the state including the high desert country of the Columbia Basin (WDFW 2014).

Management Guidelines and Objectives

The statewide goals for moose (WDFW 2014) are to:

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.
3. Manage statewide moose populations for a sustained yield.
4. Manage moose populations with a rigorous, data-based system.

Population Surveys

Prior to 2013, helicopter surveys were conducted at the District level annually 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). However, population estimates based on these surveys were found to produce highly variable estimates with large confidence intervals.

A more rigorous aerial survey protocol that covered the entire northeastern Washington moose population was initiated in winter 2013/14 and continued through the winter of 2015/16. The intent of this survey was to provide a baseline population estimate from which future trends will be assessed. A full report appears as Oyster et al. (2018).

Hunting Seasons and Recreational Harvest

Moose hunting opportunities in Washington are by permit only. Most moose hunting seasons were October 1-31, November 1-30, or both months; auction, raffle, and archery hunts began September 1st. Hunters were able to use any legal weapon except in the Parker Lake area, where archery only and muzzle-loader only hunts were authorized. The “any moose” permit category was changed into a “antlered bull moose” permit only category in 2018. Hunters having successfully taken a moose under an “antlered bull moose” permit or the old “any moose” permit are prohibited from applying for another “antlered bull moose” permit. Permit availability (and therefore hunter opportunity) increased substantially beginning in the late 1990s (Fig. 1) and is currently higher than at any time since moose hunting began in Washington State.

In 2018, there were a total of 156 moose permits available (including five terminally ill hunter antlered bull permits and one hunter instruction incentive antlerless permit), of which 146 were reported as being used by hunters, resulting in 131 moose reported harvested. Permit types available (followed by number harvested) were “antlered bull” moose (104/87), antlerless only (33/27), youth antlerless (1/1), 65-and-over antlerless (4/4), disabled antlerless (4/2), statewide raffle (2/2), Northeast Washington multi-species raffle (1/1), and statewide auction (1/1). The Department received 5 requests from terminally ill hunters for permits; all 5 resulted in harvested of antlered bulls. Of the 131 moose reported harvested, 99 were male and 32 were female (3 antlerless moose were male calves). For statistics (e.g., number of permits, success rates, etc.) on individual hunt units please see the Hunting Prospects for District 1 and 2 http://wdfw.wa.gov/hunting/prospects/index.html. For information on hunting moose in Washington and the access in individual hunt units, read Moose Hunting in Eastern Washington found here http://wdfw.wa.gov/hunting/goat_sheep_moose/index.html.

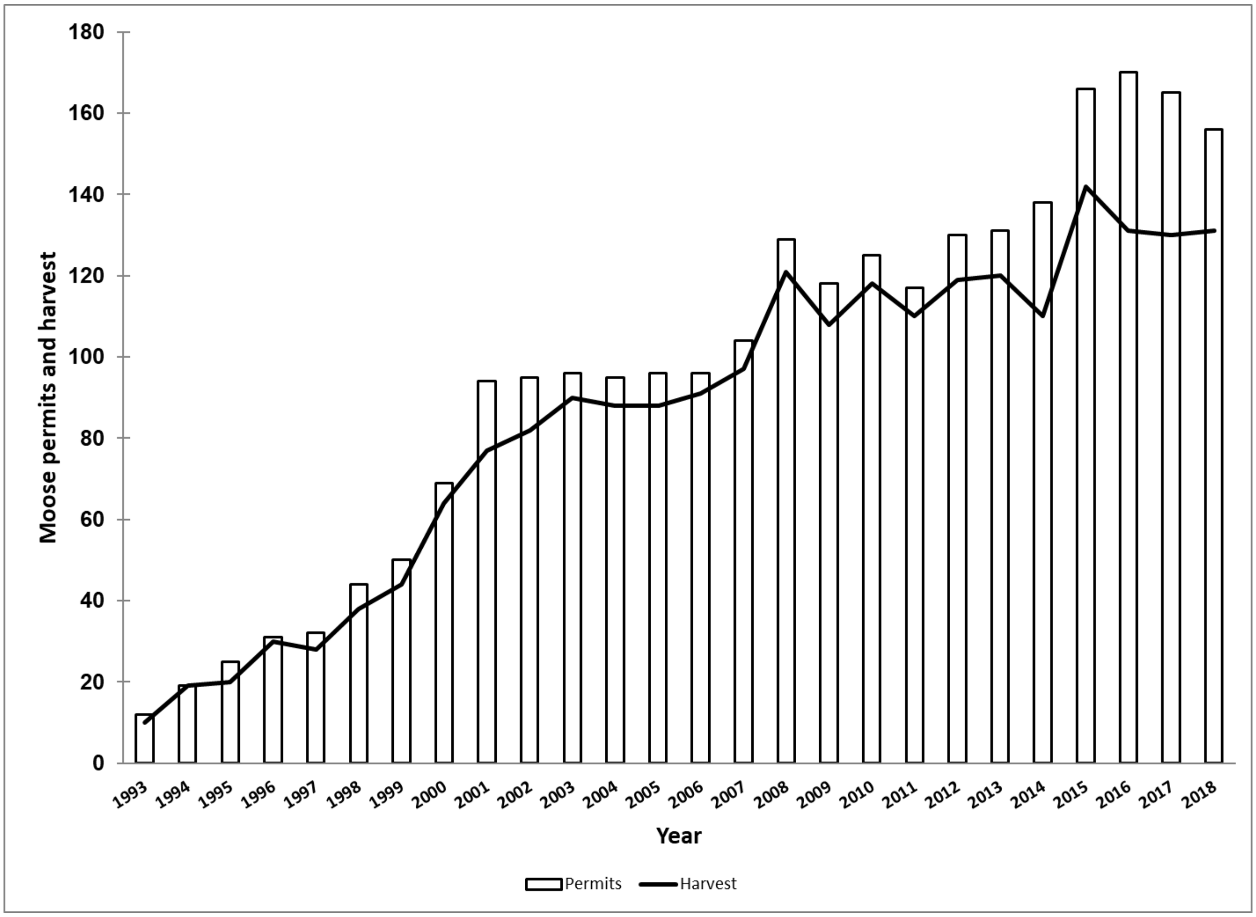

Figure 1. Moose permit numbers (open bars, not including Master Hunter and Hunter Educator Incentive moose permits), hunts reported (dashed line) and harvest reported (solid line) for moose in Washington, 1993-2018.

Habitat

Moose prefer 10-20 year old clear-cuts, burned areas, or thinned stands on mesic sites. Forested cover is important during summer heat and deep winter snow (Costain 1989). As timber harvest has declined on public lands, private industrial timberlands have come to provide a large portion of moose range in Washington. Forest regeneration in these areas tends to produce dense stands of willow, serviceberry, ceanothus, and other shrubs which are preferred browse. However, recently private industrial forests have begun using herbicides to control shrubs to reduce competition for regenerating coniferous trees. Moose can be found at any elevation in Washington but are most likely found in the 3,000 to 5,000-foot elevation band and are commonly drawn to north slopes or east flowing drainages, which are cool and moist.

Human-Wildlife Interaction

Individual moose can create human safety or nuisance concerns, especially 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 in semi-rural areas resulting in dissemination of literature and discussion on living with wildlife; to moose in dangerous situations requiring immobilization and translocation or euthanization. The number of moose incidents per year has been as high as 87 in 2001, and as low as 16 in 2009.

Research

With financial and logistic support from WDFW, the University of Montana (UM) has taken the lead in understanding factors controlling demographic parameters of moose in 2 study areas north of Spokane. A total of 74 cow moose were fitted with radio-collars during December 2013, 2014, and 2016. Survival rates of these cohorts are being estimated, as well as cause of death (in most cases). We have not captured or instrumented calves but are monitoring their survival indirectly by ground-based monitoring of their mothers. UM discontinued their lead role on field work in May 2018. We expect a Ph.D. thesis and attendant publications in spring 2020.

Management Concerns

Fire suppression, reduced timber harvest, herbicide treatment of broadleaf shrubs in regenerating forest, and human development continue 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 (as needed for cover).

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).

From 2014 through 2017, WDFW also monitored 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. A total of 126 carcasses were inspected, of which we were able to determine presence or absence of *E. schneideri* in 80. *E. schneideri* was detected in the arteries of 3 of these 80 moose; however, none of these moose showed outward signs of infection. Histology performed at the Washington Disease Diagnostic Laboratory at Washington State University detected additional damage to the carotid artery of a number of moose, but whether or not these animals were infected with *E. schneideri* remains unclear. 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 (WDFW 2015, Base et al. 2006, Nadeau et al. 2017). Hunter demand continues to far exceed supply, thus even if permit levels are increased, moose hunting will be a rare (and generally once-per-lifetime) experience for Washingtonians. Although the new aerial survey protocol is showing promise, 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 the future hunting opportunities can be developed in other parts of the state. We believe we have begun seeing a marked decline, as the moose population has likely exceeded the capacity of available forage and as other natural factors (e.g., predators, parasites, climate change) respond to their abundance.

Literature Cited

Base, D.L., S. Zender, and D. Martorello. 2006. History, status, and hunter harvest of moose in Washington state. Alces 42:111-114.

Costain, B. 1989. Habitat Use Patterns and Population Trends Among Shiras Moose, MS degree, U. of Montana.

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.

Nadeau, M. S., N. J. DeCesare, D. G. Brimeyer, E. J. Bergman, R. B. Harris, K. R. Hersey, K. K. Huebner, P. E. Matthews, and T. P. Thomas. 2017. Status and trends of moose populations and hunting opportunity in the western United States. Alces 53: 99-112.

Oyster, J. H., I. N. Keren, S. J. K. Hansen, and R. B. Harris. 2018. Hierarchical mark-recapture distance sampling to estimate moose abundance. Journal of Wildlife Management 82:1668-1679.

Poelker, R. J. 1972. The Shiras Moose in Washington. Unpublished administrative report. Washington Department of Game, Olympia, Washington, USA.

Scheffer, V. B., and W. W. Dalquest. 1944. Records of mountain goat and moose from Washington State. Journal of Mammalogy 25: 412-413.

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

Cougar

COUGAR STATUS AND TREND REPORT

STATEWIDE

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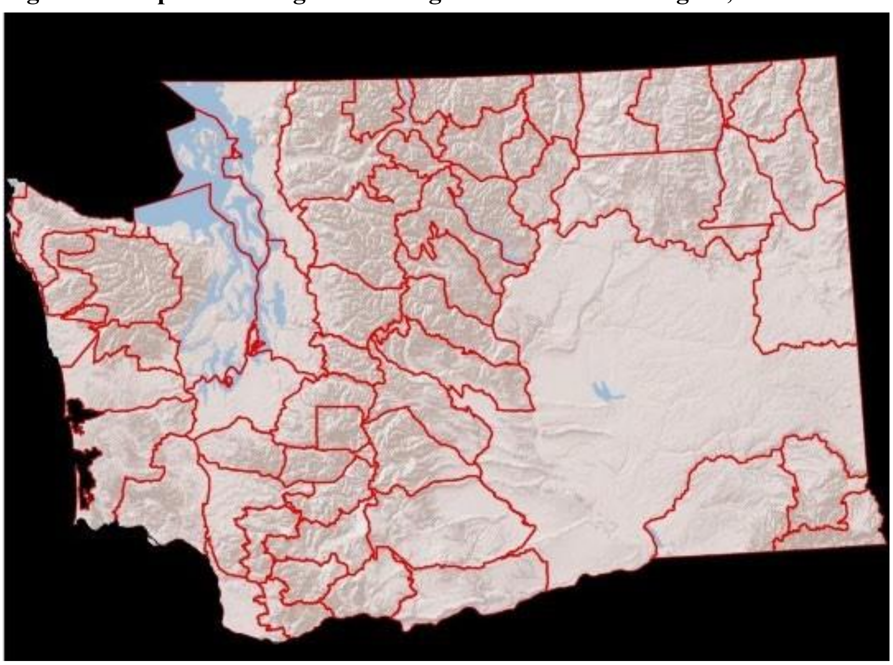
Introduction

Cougars occupy approximately 40% of the available habitats in Washington where vegetation provides adequate cover and food (Figure 1) but they typically do not occur within the island arhipelago of Puget Sound. For management purposes, the state is divided into 50 population management units (PMUs) (Figure 1). Agency cougar management objectives, strategies, regulations, and policy have been formulated using 21 consecutive years of research (1998-2019) where density and habitat has been the focus, and the PMUs were established by staff with consideration given to access, harvest history, and people. Washington has a systematic management strategy that offers an empirical, objective rationale for management while providing plentiful recreational opportunities and stable cougar populations.

Figure 1. Graphic showing the 50 cougar PMU's in Washington, 2019.



Management Guidelines and Objectives

Similar to the most western wildlife agencies in North America, Washington's hunt structure includes the implementation of harvest guidelines (also called harvest limits or quotas in other jurisdictions) which are applied to specific areas with identifiable boundaries known as PMUs. Except for the PMU that encompasses the Columbia Basin, most PMUs are approximately 1,000 km^2 in size. Hunting closures may be initiated within these PMUs when the harvest guideline is reached which the agency monitors via a mandatory hunter reporting/sealing requirement. Only hunter kills apply towards these closures. To achieve the cougar management objectives as outlined in WDFW's Game Management Plan (WDFW 2015), 45 of the 50 PMUs, have an allowable harvest of 12-16% of the independent cougar population; kittens are not included the population estimate nor the harvest rate because they are protected by law and not available for harvest. The benefits of this cougar management structure include:

- provides ample recreational harvest opportunity
- harvest that is fair and equitable across the landscape
- older-aged animals on the landscape thus a better-quality hunt
- smaller PMUs reduces large area closures that could hinder hunter opportunity
- maintains the integrity of cougar social structure and ecosystem function
- simple for diverse user groups to understand
- inexpensive to implement
- scientific, transparent, and defensible
- satisfies agency and multi-stakeholder interests

Population Surveys

Despite cougar populations being notoriously difficult to estimate, Washington is fortunate that WDFW has funded decades of long-term research and collaborated with other agencies and universities to generate 8 separate density estimates from 10 research areas within Washington (9 are shown in Figure 2). Overwhelmingly, this research has been conducted in northeast Washington but also includes the southeast, central and western portions of the state. The agency used long-term capture-collar projects with detailed home-range information to generate a density estimate. In addition to, a long-term DNA project that incorporated a spatially explicit capture- recapture. All density estimates produced results within a range that others have seen across western north America. Due to the consistency observed within the state, WDFW uses the median statewide cougar density of 2.2 cougar/100km^2 rather than opting to use distinct densities. Using a statewide median density incorporates the variation and uncertainty around each of the points. When multiplied by the available habitat in Washington, the independent-aged statewide population is estimated at 2,300 cougars. Washington's statewide median density estimate is slightly above the range-wide (from Canada to Patagonia) median density estimate of 1.98 cougars/100km^2 (S. Murphy, personal communication).

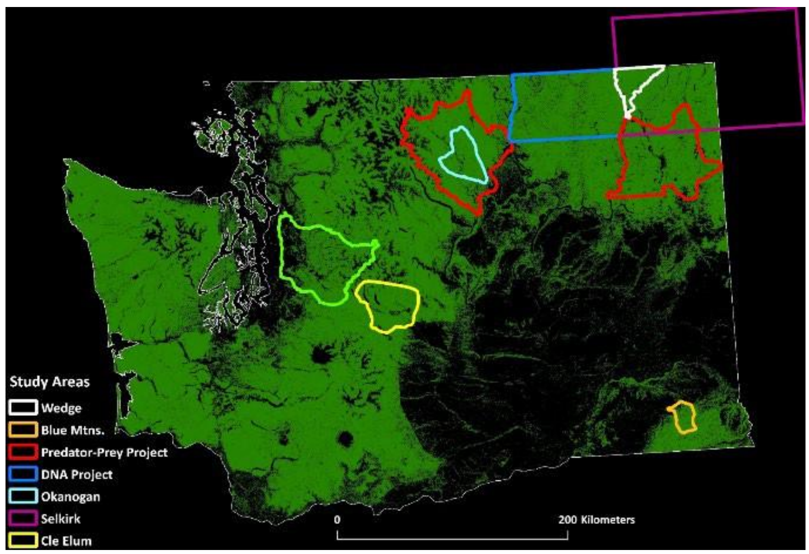


Figure 2. Cougar research areas in Washington, 1998-2019, where density estimates were derived. The average independent-aged cougar density in Washington is 2.2 cougars/100km^2. This is slightly above the average density reported throughout the cougar's range.

Because territories of adult male cougars are strongly defended, their territories are often arranged on the landscape like pieces of a puzzle, with relatively low overlap; females are similarly arranged but they are typically not territorial and have slightly more overlap. Through this behavioral-based territoriality, the overall cougar population size is often limited by the amount of available habitat. With a greater understanding of this type of social organization, Washington managers can incorporate and consider the impacts of differing levels of cougar harvest on population growth as well as social organization.

Hunting Seasons and Recreational Harvest

The cougar hunting season is currently 242 days, considerably more than Utah and Colorado (113 and 160, respectively) slightly more than Idaho and Montana (213 and 224 days, respectively) and less than Oregon, New Mexico, Wyoming, Arizona, and Nevada, which are year-round (McLaughlin and Vieira 2017). Washington currently uses an early and a late general season. In the early season, (September 1 – December 31) no harvest limits apply, even if harvest exceeds the guideline. In the late season, (January 1 – April 30) harvest limits apply. If the guideline is met or exceeded by December 31; the PMU may not open for the late season. Over the past 5 years, an average of 65% of PMUs remained open to hunters through April 30. Closures occur on the PMU level, resulting in less impact to hunter opportunity.

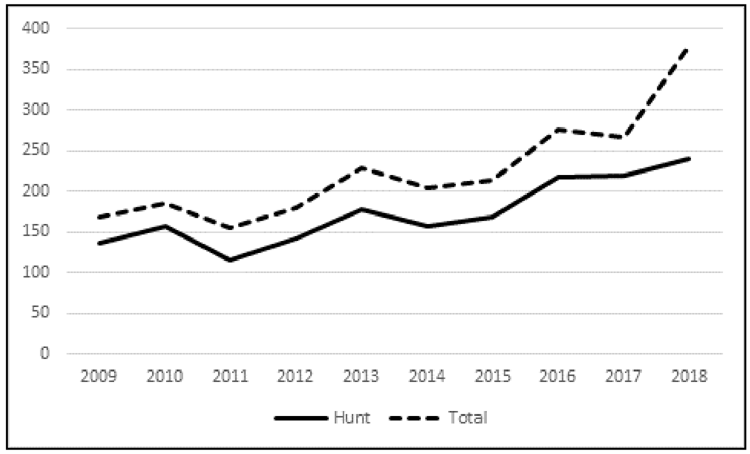


Figure 3. Cougar hunter harvest and known total cougar mortality from the 2009-10 through the 2018-19 season, Washington Department of Fish and Wildlife. Tribal kills and natural mortality is unknown and not included.

The most recent annual five-year average for cougar hunter harvest is 200 animals. Incorporating all mortality types (including roadkill, agency removals, poaching, etc.) produces and averages 267 animals. This is an increase over the previous 5-year average of 146 and 183 for hunter harvest and total mortality, respectively. The overall 10-year average cougar hunter harvest is 173 annually and total mortality is 225 animals annually.

Washington has a mandatory reporting system for cougars. Hunters are required to present the hide and skull (with proof of sex attached) to the agency for sealing. Harvest location is typically recorded at a fine scale within a GMU, sex and age characteristics are collected from kills, and a tooth is pulled for ageing. Since 2004, the agency has provided hunters with updates on the status of open and closed PMUs via a hotline or by checking the agency's website.

Survival and Mortality

Hunting is the main source of mortality for cougar populations across Washington. Hunting mortality averages 77% of the documented human-caused mortalities over the most recent 5-years. Compared to 81% for the previous 5-year average and the 10-year average of 80%. Other human caused mortalities include agency removals, road kills, landowner kills, and poaching (Figure 3). It is important to mention that agency removals do not apply towards the harvest guideline.

Hunting harvest has increased in the 22-years since Initiative 655 banned the use of hounds as a hunting aid. With the expectation that hunter success would decrease without the use of hounds, hunting seasons were expanded from an approximately 75-day average (1978-1997) to an average of 230 days (1998-2019); license sales have also increased from approximately 2,000-3,000 to 5,000 annually. Along with those changes to the hunt structure and harvest levels came a considerable change in female harvest. Martorello and Beausoleil (2003) first described this change with a 6-year pre-and post-Initiative analysis that showed female harvest went from an average of 42% to 59%, respectively. Following that time, a limited hunt using dogs as a hunting aid was initiated by the Washington State Legislature (SB 5001, SB 6118, HB 1756) where female harvest dropped slightly to an average of 48% (2000-2011) but has since climbed back up to average 53% (2012-2019) when HB 1124 failed to pass and the use of dogs was no longer allowed. The aid of dogs in a hunt can offer hunters multiple opportunities to chase and tree cougars throughout the season thus allowing the hunter the ability to wait for a larger male, which is what most cougar hunters prefer.

Habitat

Available cougar habitat was recently reassessed in 2018, using research data and the current habitat estimate encompasses approximately 104,500 km^2 throughout Washington; 91,000 km^2 of which WDFW manages for hunting opportunity. The National Parks and tribal lands do not fall under WDFW's management authority, but many tribes conduct their own hunting programs. Washington is the smallest of the western states and has the least amount of available cougar habitat. Idaho has approximately 99% more habitat, there is 84% more habitat in Montana, and 61% more habitat in Oregon.

Human-Wildlife Interactions

Minimizing human-wildlife conflict is a management priority for WDFW. The human population in Washington is currently estimated at 7.5 million people, double what it was in the 1970's, and is only expected to increase. With more people comes more recreationists in cougar habitat, more hobby farms, and more intentional and unintentional feeding of wildlife around homes. Therefore, it is imperative we use a comprehensive outreach and information program to prevent negative human-wildlife interactions. Overwhelmingly, the common causes of interactions identified by staff include the feeding of deer and turkey which brings cougars closer to human development and husbandry practices of livestock and domestic animals. Understanding how to reduce ungulate attractants and installing affordable electric fencing for goats, sheep, and fowl is the best approach to avoiding or minimizing potential interactions. Information and outreach materials are a mandatory component of staff response to potential conflict events. In 2018, an updated cougar brochure was developed (Figure 3); and in 2019, a large number were printed and distributed to all WDFW regional offices.

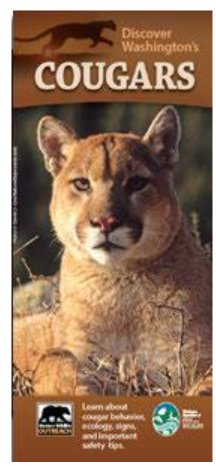


Figure 4. The "Discover Washington's Cougars" brochure was developed in 2018 in cooperation with Western Wildlife Outreach.

Population Augmentation

No population augmentation takes place for cougars in Washington.

Research

In the 21 consecutive years that WDFW has funded or co-funded numerous cougar research projects, over 24 peer-reviewed manuscripts have been published in top tier journals. Research topics include density and abundance, population demographics, social organization, growth rate, habitat and space use, resource selection, genetic structure, prey use, effects of hunting, harvest rates, and using DNA to evaluate agency and hunter ability to determine sex ID. The only ongoing project involving cougars is a predator-prey research project which started in 2016. The goal of the research is to assess how hunting and predation may affect Washington’s ungulate population dynamics as well to document wolf-cougar interactions and assess survival and causes of mortality.

Management Concerns

Exceeding harvest beyond management objectives continues to be a concern. On average, 32% of the PMUs within a given hunt season close (range = 16-50%) and of the 45 PMUs with harvest limits, 18% go beyond the upper end of the harvest guideline (Table 1). About half of the overages occur prior to January 1 (when harvest limits do not yet apply) and the other half after harvest guidelines take effect and hunters must call within 72 hours; this causes a lag time in closure. Percent of female harvest is also a concern as changes in adult female and kitten survival are the most influential parameters to population growth (Martorello and Beausoleil 2003). Over the past 10 years, females average 53% of the harvest but it is unknown if that percentage of the harvest rate is at a level where this would be a management concern. Finally, harvest that occurs outside of WDFW’s management authority remain unknown and are not accounted for in harvest guidelines. These additional harvests are an additive source of take, particularly in the northeast and Olympic peninsula regions of Washington. Accounting for that unknown additional harvest and evaluating its effect is difficult without accurate data records.

Management Conclusions

The current cougar management structure allows the Department to address concerns of various constituencies. For hunters, it provides older aged animals on the landscape thus a better-quality hunt, it allows harvest to be equitable across the entire jurisdiction, and when closures do occur, it does not impact a large-scale landscape forcing hunters to travel long distances. For non-consumptive users, it recognizes their values by maintaining population stability, social structure, and ecosystem integrity. For managers, it’s defensibly based in science, ensures credibility, it’s simple for multiple user groups to understand, inexpensive to implement, and satisfies multi-stakeholder interests. The current structure of distributing harvest equitably across the landscape is being demonstrated as harvest clusters are declining and distribution of harvest is increasing. Two potential solutions to avoid exceeding harvest guidelines is to revert back to the 24-hour closure in Washington and to the single season structure, both successfully used prior 2015. Snow conditions are strongly correlated with cougar harvest and affect hunter success. Being able to respond to hunting conditions would improve the Department’s ability to manage harvest and direct hunters to nearby open PMUs during optimal hunting conditions. The majority of agencies throughout the west utilize a 24-hour closure when harvest guidelines are met. Additionally, establishing an agreement to document tribal harvest of cougar would benefit statewide management in the future. Finally, further developing a cougar education program focused on preventing conflicts needs more attention.

Table 1. Harvest objectives and actual harvest, by PMU and season. Shaded areas depict PMU closure and bordered areas indicate harvest objectives were exceeded.

Region	PMU	Harvest Objective	Actual Harvest						
			2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
1	101	7-9	1	5	10	2	8	9	13
	105	2	2	2	4	2	5	2	2
	108, 111	5-6	6	6	7	8	11	12	10
	113	4-6	3	5	6	3	4	6	5
	117	6-8	9	12	12	10	11	12	14
	121	5-6	7	5	8	4	17	9	6
	124, 127, 130	7-9	8	5	8	4	11	11	9
	145, 166, 175, 178	3-4	7	6	7	3	6	6	7
	149, 154, 157, 162, 163	4-6	10	10	4	6	12	15	18
	169, 172, 181, 186	3-4	4	4	1	2	7	3	5
2	203	4-6	0	0	0	0	0	0	0
	204	6-8	4	5	1	7	2	6	10
	209, 215	4-5	4	2	4	3	3	5	5
	218, 231	4-6	2	3	2	1	5	0	3
	224	2-3	1	2	1	0	3	2	3
	233, 239	3-4	2	0	1	1	6	1	4
	242, 243	4-6	4	4	3	1	3	2	7
	244, 246, 247	5-6	3	3	0	2	5	7	5
	245, 250	5-6	2	0	4	1	6	3	3
	249, 251	5-6	6	6	2	1	6	1	6
3	328, 329, 335	6-8	10	9	7	8	11	8	8
	336, 340, 342, 346	5-7	8	5	6	8	6	12	7
	352, 356, 360, 364, 368	5-7	6	5	6	5	10	7	7
	382, 388	3-4	4	10	1	3	3	3	4
4	407	none	2	1	2	1	1	3	1
	418, 426, 437	11-15	1	2	0	8	3	4	4
	448, 450	9-13	0	0	0	0	0	3	1
	454	none	0	2	3	0	0	1	0
	460	5-7	2	1	0	2	0	2	3
	466, 485, 490	2-3	0	2	0	1	0	0	0
5	501, 504, 506, 530	7-10	1	1	2	1	1	1	4
	503, 505, 520, 550	6-8	0	2	7	0	2	1	3
	510, 513	3-4	0	1	2	3	1	2	0
	516	3-5	1	3	3	0	3	2	4
	522, 524, 554, 556	3-4	1	0	0	1	1	2	0
	560	5-6	1	4	1	3	1	3	5
	564	1	0	0	0	0	0	0	0
	568	2	2	3	0	4	1	4	4
	572	3-4	1	2	1	3	0	1	1
	574, 578	3-5	3	5	4	5	3	5	7
6	601, 602, 603, 612	5-7	1	3	2	1	1	0	2
	607, 615	4-5	0	1	0	1	2	2	2
	618, 636, 638	4-5	2	4	4	0	1	4	1
	621, 624, 627, 633	none	2	5	1	2	8	2	7
	642, 648, 651	6-8	10	6	6	3	5	10	10
	652, 666	none	2	1	1	0	1	0	1
	653, 654	4-6	1	1	1	2	3	1	4

Table 1. Harvest objectives and actual harvest, by PMU and season. Shaded areas depict PMU closure and bordered areas indicate harvest objectives were exceeded. (Continued)

Region	PMU	Harvest Objective	Actual Harvest						
6	658, 660, 663, 672, 673, 681, 684, 699	9-12	1	1	1	0	3	7	3
	667	3-4	1	3	7	3	5	3	1
1, 2, 3	133, 136, 139, 142, 248, 254, 260, 262, 266, 269, 272, 278, 284, 290, 330, 334, 371, 372, 373, 379, 381	none	11	13	10	14	22	17	15

Literature Cited

Martorello, D. A. and R. A. Beausoleil. 2003. Characteristics of cougar harvest with and without the use of dogs. Pages 129-135 *In* S.A. Becker, D. D. Bjornlie, F. G. Lindzey, and D. S. Moody. Editors. Proceedings of the Seventh Mountain Lion Workshop. Wyoming Game and Fish Department, Lander, Wyoming, USA.

McLaughlin, C. R. and M. Vieira, editors. 2017. Proceedings of the 12th Mountain Lion Workshop, May 15-18, 2017. Estes Park, Colorado, USA.

Black Bear

Black Bear Status and Trend Report

STATEWIDE

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LINDSAY S. WELFELT, Carnivore Section, Assistant Bear & Cougar Specialist

Introduction

Black bears (*Ursus americanus*) occupy all forested areas, which translates to 48% of the land area throughout Washington. The northern island counties within the Puget Sound archipelago, the shrub-steppe habitat of the Columbia Basin, and developed areas do not support resident black bear populations. For management purposes, the state is divided into 9 black bear management units (BBMUs, Figure 1) consisting of the Olympic Peninsula or Coastal (1), Puget Sound (2), North Cascades (3), South Cascades (4), Okanogan (5), East Cascades (6), Northeast (7), Blue Mountains (8), and Columbia Basin (9) units.

Management Guidelines and Objectives

Currently, the Department uses median age of males and females, and percent females of hunter harvest to evaluate harvest management objectives and monitor trends within the 9 BBMUs (Table 1) (WDFW 2015). To obtain median age, WDFW has a mandatory tooth submission requirement where teeth are collected from harvested bears and sent to an independent lab to be sectioned, stained, and aged. Despite tooth submission being required by law (WAC 220-415- 090), over 75% of hunters do not submit a tooth, so data used to evaluate this metric are from a small portion of harvested animals.

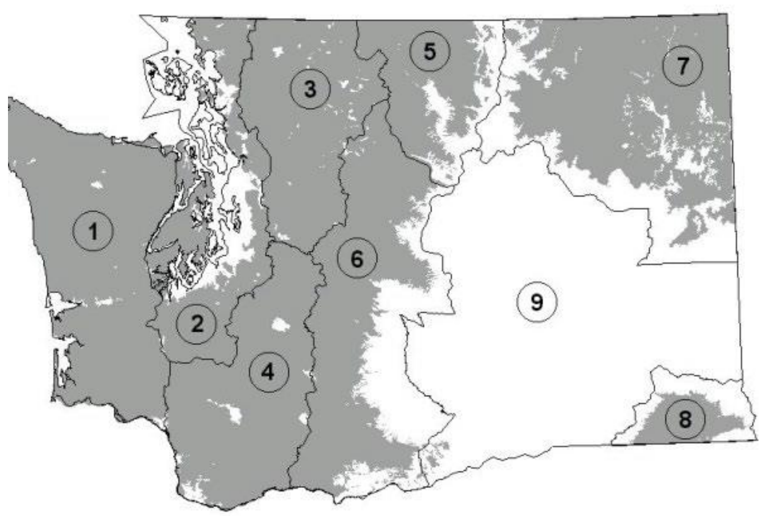


Figure 1. Black bear distribution (in gray) and 9 black bear management units in Washington 2019.

Parameter	Harvest		
	Liberalize	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

Table 1. Black bear harvest guidelines.

Generally, median ages can be a reflection of hunting pressure and tend to be lower in areas with greater access. We realize that this method has some challenges, and we are working to develop better methods to monitor bear densities. Until we have a workable alternative, we will continue to use this metric.

Black bear density is not uniform across the landscape and can vary based on habitat quantity and quality, levels of hunting and non-hunt mortality, and local bear population growth rate. The greatest management need is to acquire a better understanding of black bear density and abundance throughout the state thus allowing the agency to calculate a harvest rate that would improve management markedly.

Table 2. Percent female black bear mortality, by year and BBMU in Washington, 2009-2018. Gray areas show where management objective was exceeded.

Percent Female Mortality												
YEAR	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**10-yr Avg**	**5-yr Avg**
BBMU 1	39	36	N/A	30	32	28	27	29	35	36	33	31
BBMU 2	38	44	N/A	36	42	39	34	43	35	33	38	37
BBMU 3	27	35	N/A	36	32	38	31	42	26	40	34	35
BBMU 4	32	39	N/A	31	31	44	24	37	35	40	35	37
BBMU 5	35	31	N/A	33	27	32	27	32	36	38	32	33
BBMU 6	37	36	N/A	27	30	34	34	35	31	34	33	33
BBMU 7	33	35	N/A	33	31	33	34	32	37	33	34	34
BBMU 8	38	39	N/A	35	29	29	38	37	29	43	35	36
BBMU 9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Population Surveys

Between 2013 and 2016, the Department conducted research to estimate black bear density for the first time in over 3 decades. This research was focused in the North Cascade Mountains using 2 detection methods, non-invasive DNA collection and physical capture and deployment of global positioning system (GPS) collars. Results showed that while density varied by human development and habitat productivity, it averaged 20 bears/100 km^2 in western Cascades and 19 bears/100 km^2 in eastern Cascades (Welfelt et al. 2019). In western Washington, average total density estimates (including cubs) were nearly 50% lower than expected prior to this research. In eastern Washington average black bear density was predominantly as expected. It is not wise to use these research results to extrapolate to a statewide black bear density given the variability of habitats statewide.

In 2019, after refining density estimation methods from Welfelt et al. (2019), WDFW biologists replicated this density estimation effort in two additional areas of the State, one in northeast Washington around Chewelah, and one in southwest Washington between Chehalis and Grays Harbor. That project concluded in August 2019 and 1,625 samples were collected and sent to an independent lab for individual and sex ID. In 2020, we expect to be able to generate 2 additional densities using this data. Research is also anticipated to be expanded to 2-3 additional areas for further density comparison. With multiple density estimates in a variety of habitats, WDFW can examine what habitat and human factors are associated black bear density across Washington State and estimate statewide population abundance more accurately.

Hunting Seasons and Recreational Harvest

Washington does not implement harvest limits for bears and does not have a mandatory sealing requirement. Tags can be purchased over the counter and there is no limit on the number of licenses that can be sold. The Department provides a total of 183 hunt-days for spring and fall recreational hunting opportunity for black bears and roughly 35,000 licenses are sold annually. Spring hunting is by permit only and authorized in specified areas, whereas fall hunting is unlimited, and hunters can hunt anywhere hunting is legal and firearms can be discharged. Spring hunts take place in 5 BBMUs and fall hunts occur in all 9 BBMUs. In 2019, WDFW increased the bag limit of bears from 1 to 2 in eastern Washington and increased the season length up to 30 days in some areas to standardize the dates of the fall general season to August 1 – November 15 in all black bear hunting areas statewide.

The timber damage removal program also occurs in spring and early summer but is managed separately, whereby timber companies that have been granted black bear removal permits may select hunters to participate in removal efforts. In 2019, timber damage removal did not occur due to ongoing litigation.

Over the past 10 years, Washington's average annual black bear harvest was 1,710. The average fall harvest over the past 5 years is 1,419 and spring is 108. The previous 5-year averages are 1,483 and 72, respectively. Typically, the highest percentage of bear harvest from the fall general hunt takes place in the Northeast BBMU and the least from Blue Mountains BBMU (excluding the Columbia Basin BBMU). However, when harvest numbers are compared to the amount of black bear habitat (known as harvest density), the Blue Mountains BBMU has the highest harvest density compared to the South Cascades BBMU which has the lowest. Spring special permit harvest is generally related to number of permits granted.

When viewed by mortality type at a statewide level over the past 10 years, most bear mortality occurs in fall hunting season (85%), followed by timber removals (7%), and spring permit hunts (5%) (Figure 2). Hunting bears with the aid of dogs and bait has been prohibited in Washington for over two decades (RCW 77.15.245). However, the use of dogs is allowed for timber damage removals on commercial timber lands in the spring.

Unlike other agencies that have mandatory sealing requirements of pelts and skulls, the Department collects hunt statistics via online reporting. Currently, the reporting rate is about 65% and the Department is able to collect the number of harvests, sex of harvests, number of days hunted, and GMUs hunted to calculate hunter success. Since 2018, hunters that choose to hunt in GMUs located in grizzly bear recovery areas as identified by the Department must successfully complete an annual online bear identification test and score 80% or higher. Although not currently prohibited by law, the Department urges hunters not to shoot cubs or a female with cubs.

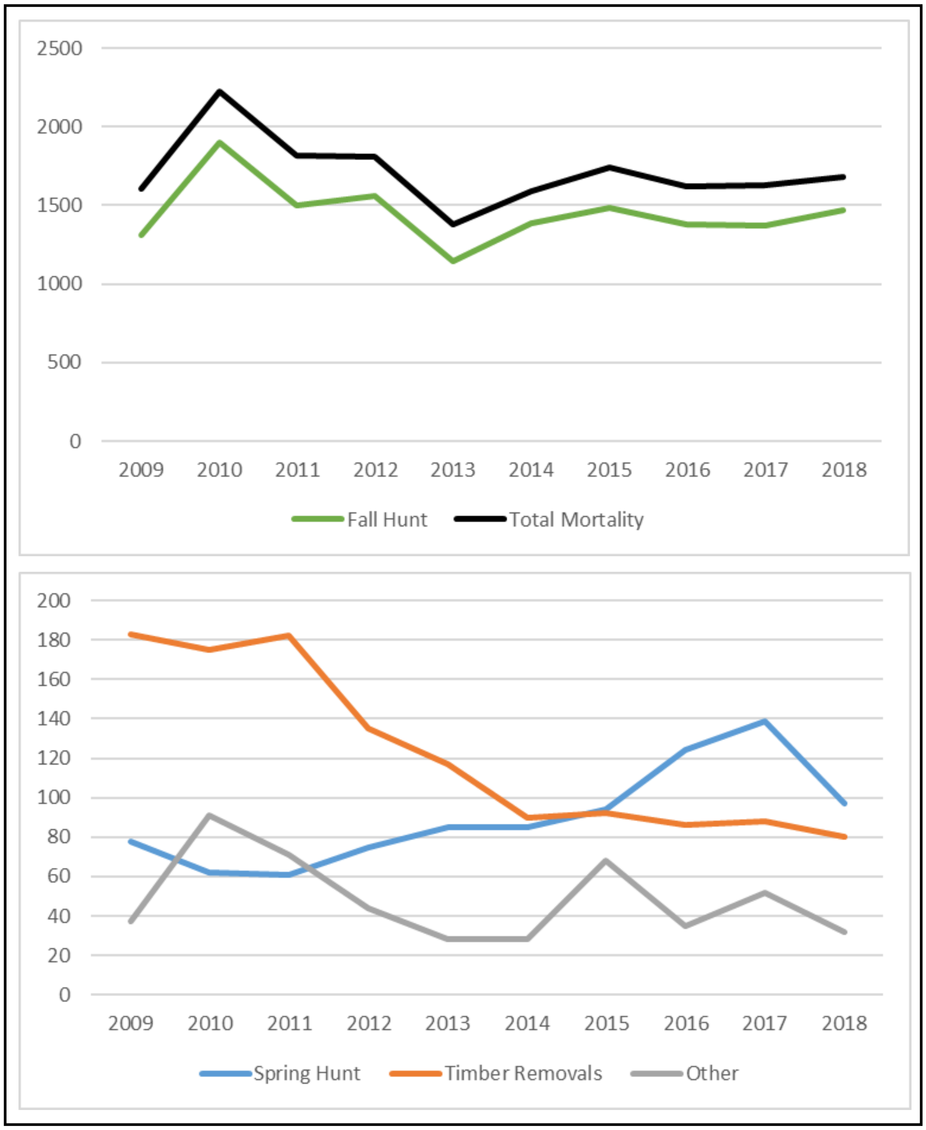


Figure 2. Black bear mortality, by type and year, in Washington, 2009-2018[a]
[a] Does not include tribal harvest.

Survival and Mortality

Research projects conducted in Washington demonstrate that non-harvest mortality can be a factor in overall mortality (WDFW 2018). In the ongoing North Cascades black bear research project (2013-current) where 235 bears have been GPS collared to date, nearly all documented mortality was human related. On the west slope of the North Cascades 52% of mortalities were hunter kills, 17% were conflict kills, 11% were poached, 7% were wounding loss, 7% were roadkill, and 7% from natural causes. On the east slope of the North Cascades 71% were hunter kills, 15% were natural causes, 7% were conflict kills, 5% were from wounding loss, and 2% were road kills.

Habitat

Washington is the smallest of the western states and has the least amount of bear habitat at 88,000km^2. Approximately 43% of bear habitat is under state or federal ownership, while 32% is owned by industrial private timber companies, resulting in variable land management practices. Because a variety of habitat and human factors can affect bear numbers, population density can vary widely in different habitats throughout the state. Additionally, the perception that large tracts of forested habitat provides security for bear populations may be misguided if habitat is adjacent to human populated areas or human access and disturbance is high.

Human-Wildlife Interaction

Human-bear conflict activity reflects the variability of environmental conditions and the availability of human-provided attractants, and is therefore, not a good indicator of population status (Spencer et al. 2007). For example, annual human-bear conflict numbers could rise simply due to a late spring with poor natural forage conditions, followed by a poor fall huckleberry crop. The human population in Washington is currently estimated at 7.5 million and most human-bear interactions take place in King County, which is Washington's most densely human populated area with 2.2 million people. Nonetheless, human-bear conflict can occur statewide given the distribution of people and bears in Washington and the prevalence of high calorie attractants like garbage, bird feeders, and fruit trees. Managers agree that garbage management and the removal of attractants is the single best way to reduce bear-human interactions; to that end, entities intentionally or unintentionally feeding bears may be fined under state law (RCW 77.15.790, 77.15.792). Additionally, homeowners are advised to practice good animal husbandry, including using cages and/or electric fencing for chickens and other small-medium sized livestock (e.g., goats and sheep) and keeping enclosures away from forest edges. In 2016, the Department partnered with author Linda Masterson to produce information and outreach pocket guides to further information sharing (Figure 3).

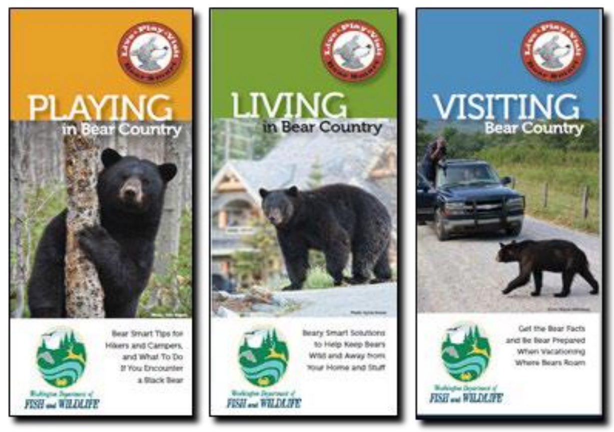


Figure 3. Black bear pocket guides developed for Washington in 2016 in a partnership with author Linda Masterson.

Population Augmentation

No population augmentation takes place for black bears in Washington.

Research

In 2019, carnivore section staff published the first empirically derived density estimate for black bears in over 30 years (Welfelt et al. 2019). This is the first in a series of manuscripts that will be compiled from a long-term research project (2013-current) in the North Cascade Mountains. Future topics will include growth rates (survival and reproduction), den selection, timing and characteristics, and stable isotope analysis to examine impacts of human foods on black bears and human-bear interactions. In 2019, DNA research was expanded to obtain two additional density estimates (see Population Surveys).

Since the North Cascades bear project was concurrent with an ongoing cougar research project, the Department, in cooperation with the University of Washington, is partnering with a Ph.D. student to compare GPS collar data from black bears and cougars and examine resource selection and interactions between these two species in western Washington.

Management Concerns

Hunter reporting (~65%) and mandatory tooth collection (~25%) need agency attention. At the time this report is being written, a mandatory pelt and skull sealing requirement for spring black bear hunters is being proposed. This could serve as a test of hunter responsiveness as well as agency staff workload for managers to evaluate both. Collecting teeth from harvested black bears is one of the least expensive and time efficient tools managers have available and it facilitates a working relationship with the hunting public, so they become partners in management.

Updating and improving the criteria used for evaluating harvest objectives would improve agency management considerably. Most agencies have moved away from using median ages and have implemented specific harvest rates based on density estimates and management objectives. With empirical density estimates now being obtained, the first in more than 30 years, Washington could in the future have the option of using harvest rates rather than median ages as a way to evaluate harvest. Second, the percentage of females in the harvest is an important factor affecting bear populations. Currently, there is no mechanism in place for management action to occur when female harvest objectives are exceeded in BBMUs. Furthermore, the size of the BBMUs, and the fact that they incorporate multiple districts, affects the ability for staff to detect when local objectives are exceeded. Smaller BBMUs that align with district boundaries would allow staff an improved capability to monitor harvest that occurs in within their District and evaluate harvest objectives.

It is well documented that black bear densities can vary considerably. In 2020, the Department will have 4 independent densities from various portions of the state. We are continuing research in other habitat types and acquiring additional science-based density estimates, which can then be used to evaluate local harvest objectives and would improve the Department’s black bear management program.

Agency staff routinely give educational presentations when requested, but the Department does not have a formal black bear education and conflict prevention program. Overwhelmingly, human-bear conflicts involve attractants being provided by people including garbage, bird feeders, and fruit trees. Much of this is outside of agency jurisdiction, but more attention working with city councils on contract renewals for garbage management and expanding the options for bear-proof containers and dumpsters for residents and businesses would be the most impactful. Second, working with city councils and homeowner’s associations on developing focused ordinances and covenants that restrict the use of seed and liquid bird feeders has been shown to be highly effective on reducing human-bear conflict. Finally, educating orchardists and homeowners on the importance of removing ripened fruit from trees is a preventative and relatively simple way to avoid attracting ungulates and bears. More complicated is working with orchardists on disposal of unmarketable fruit. It's common to dig a hole on their property and deposit this fruit throughout the season, but unless the fruit is routinely covered by earth, it becomes a significant and rewarding attractant to a bear.

Management Conclusions

Incorporating black bear research results and updating WDFW's black bear management plan is a priority as management has essentially remained consistent since the 1970s. Recent research results can facilitate in that effort with input from staff. In 2019, the development of the 2021-2027 Game Management Plan was delayed. So rather than the draft being written in 2019, it will be written in 2020, and then the Department can move forward with the public input process. Density estimates will be the most notable addition, which will help implement an updated management strategy.

Literature Cited

Bender, L. C. 1997. Estimating black bear population size and trend in Washington State. Pages 63–68 In R. A. Beausoleil and S. Pozzanghera. Editors. Proceedings of the 6th Western Black Bear Workshop. Washington Department of Fish and Wildlife, Olympia, Washington, USA.

Lindzey, F., K. Barber, R. Peters, C. Meslow. 1986. Responses of a black bear population to a changing environment. International Conference for Bear Research and Management 6:57-63.

Masterson, L. 2016. Living with Bears Handbook. Pixyjack Press, Masonville, Colorado, USA. Poelker, R.J. and H. D. Hartwell. 1973. Black bear of Washington. Bulletin 14. Washington State Game Department, Olympia, WA USA.

Spencer, R. D., R. A. Beausoleil, and D. A. Martorello. 2007. How agencies respond to human black bear conflicts: a survey of wildlife agencies in North America. Ursus 18:217–229.

Washington Department of Fish and Wildlife. 2015. Game management plan: July 2015 – June 2021. Olympia, WA, USA.

Washington Department of Fish and Wildlife. 2018. Black Bear Status and Trend Report. Pages 237-245 in 2017 Game Status and Trend Report. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, WA, USA.

Welfelt, L. S., R. A. Beausoleil, and R. B. Wielgus. 2019. Factors associated with black bear density and implications for management. Journal of Wildlife Management 83:1527- 1539.

Band-Tailed Pigeon and Mourning Dove

Band-Tailed Pigeon/Mourning Dove Status and Trend Report

STATEWIDE

KYLE A. SPRAGENS, 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.

Population Surveys

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. In 2016, the Naselle River mineral site was added as operational to the index is it met the minimum criteria of a known naturally occurring mineral site and at least 2 annual counts (Table 2). In 2019, the main perch tree at Warm Beach was cut down causing birds to scatter in distribution and logistics of future counts at this site uncertain.

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.

Results

Band-tailed Pigeon call-count Survey

Past call-count survey results are presented in Table 1 and Figure 1.

Band-tailed Pigeon Mineral Site Survey

Cooperators from WDFW and USFWS completed 14 surveys during the July 10-20, 2019 survey period. Mineral site survey raw data summaries are presented in Table 2 and Figure 1. Complete 2019 survey results are available through USFWS (Seamans 2019).

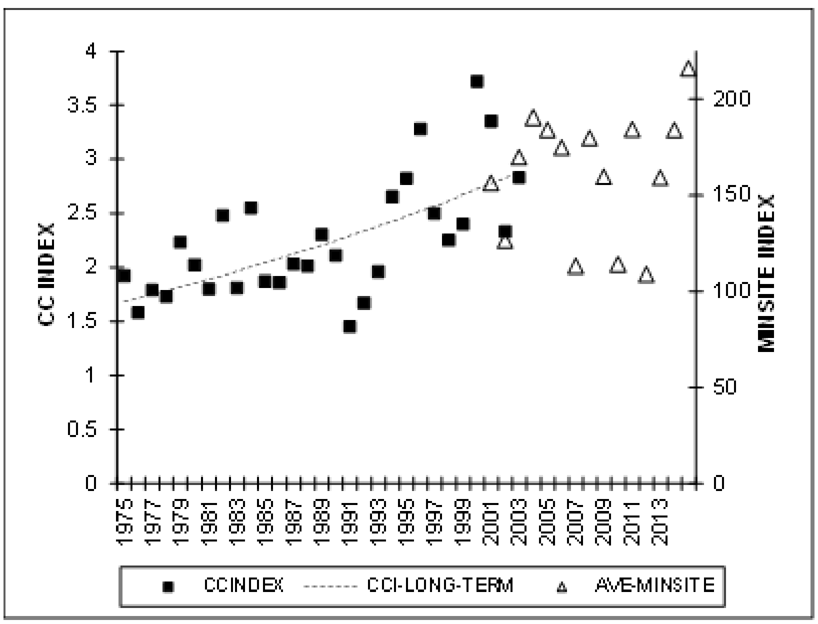


Figure 1. Band-tailed pigeon call-count results and mineral site raw data summaries.

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).

Hunting Seasons and Recreational Harvest

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 current season dates of September 15-23 and bag/possession limits of 2/6. The mourning dove season was September 1-15 from 1980 through 2007. Current season frameworks allow for the Western Management Unit to allow up to 60 days, with Washington selecting September 1 – October 30 with a bag/possession limits of 15/45.

Methods

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 2018).

Results

Band-tailed Pigeon Harvest

Harvest and hunter activity for the 2002-2018 seasons are summarized in Figures 2-3 and Table 3.

Mourning Dove Harvest

As measured by WDFW (2018) small game surveys, harvest in 2018 was estimated at 50,844 doves, down 3.9% from 2017, and 1.9% below the recent 10-year average (Figure 4). Hunter numbers were estimated at 3,829, down 1.4% from 2017 and 5.8% below the recent 10-year average. Number of days hunted was 12,198, down 6.3% from 2017. However, despite long- term declines and depressed participation compared to the 1970s, when the number of dove harvest per hunter is considered, 2018, represents the fourth highest success rate estimate since 1970 at 13.3 dove per hunter (Figure 4). The highest value was recorded in 2015 at 15.2 dove per hunter.

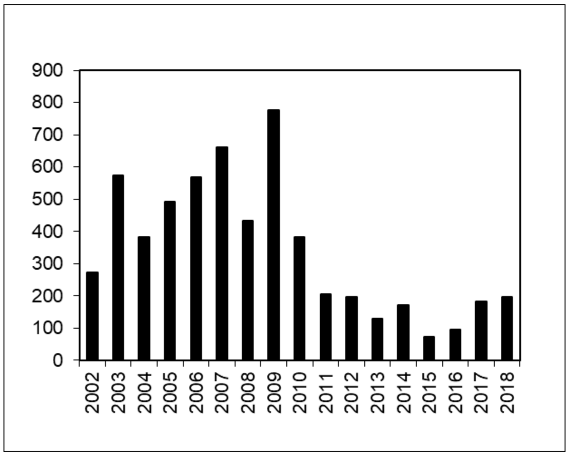


Figure 2. Band-tailed pigeon total harvest since 2002 when a season re-opened per Pacific Flyway Management Plan.

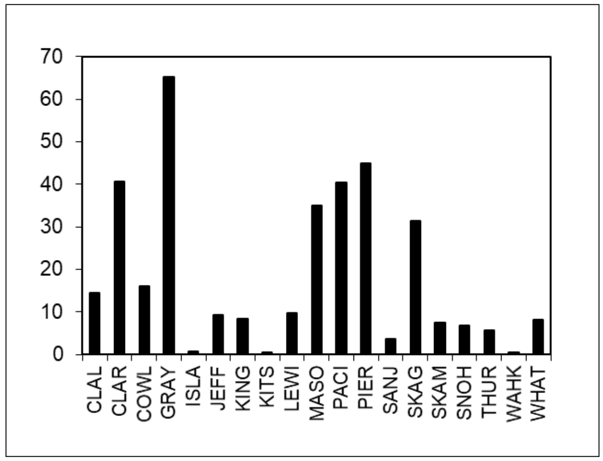


Figure 3. Band-tailed pigeon 2002-2018 average annual harvest by county.

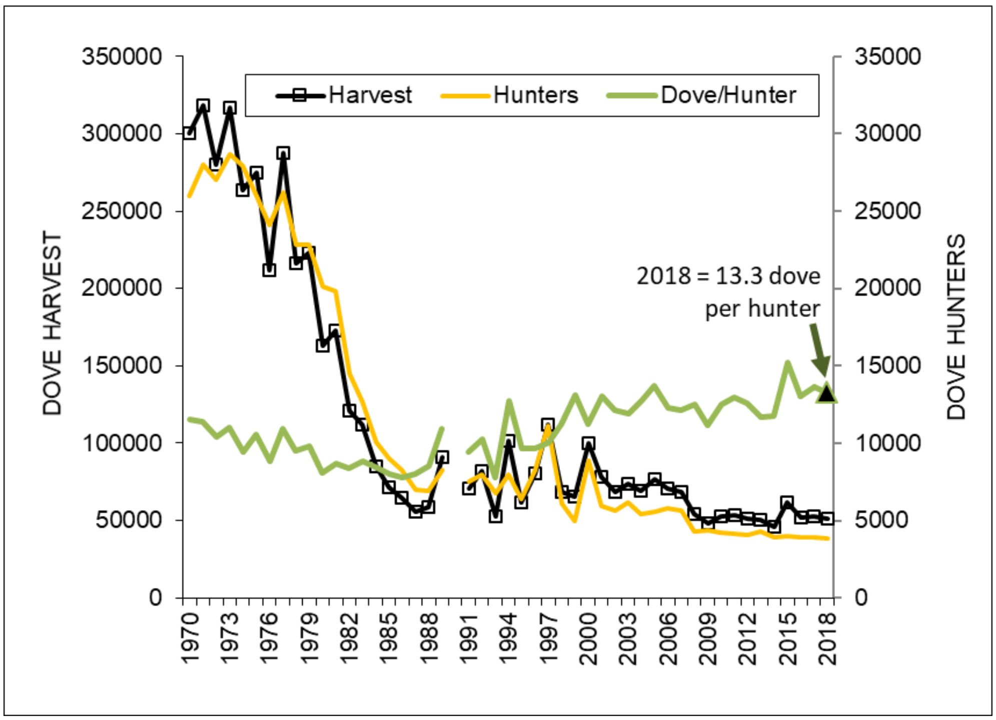


Figure 4. Mourning dove statewide harvest and hunter numbers 1970-2018.

Literature Cited

Jeffery, R. 1989. The band-tailed pigeon in Washington. Unpublished report. WDFW, Olympia WA.

Overton, C. and M. Casazza. 2004. Pacific Coast mineral site survey for breeding band-tailed pigeons – Washington. Unpublished report. USGS, Dixon CA.

Pacific Flyway Council. 1994, 2010. Pacific Flyway management plan for the Pacific Coast Population of Band-tailed Pigeons. Pacific Coast Band-tailed Pigeon Subcomm., Pacific Flyway Study Comm. [c/o USFWS], Portland, OR. Unpubl. rept.

Seamans, M. E. 2019. Band-tailed pigeon population status, 2019. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C.

Sauer, J. R., J. E. Hines, and J. Fallon. 2003. The North American Breeding Bird Survey, Results and Analysis 1966 - 2002. Version 2003.1, USGS Patuxent Wildlife Research Center, Laurel, MD.

Seamans, M. E., and T. A. Sanders. 2014. Mourning dove population status, 2014. U.S. Department of the Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Washington, D.C.

WDFW 2018. 2018 game harvest report. http://wdfw.wa.gov/hunting/harvest/ WDFW, Olympia WA.

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		-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.

Table 2: WA band-tailed pigeon mineral site survey raw data 2004-2019.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Altoona	64	0	5	0												
Cedar Cr.	215	185	231	191	312	163	154		142	181	267	207	306	246	145	308
L. Cavenaugh - Pefley	108	172	76	71	117	70	89	113	146	156	110	98	149	148	83	67
Lilliwaup	199	143	273	141	89	110	123	167	74	210	197	178	251	143	292	390
McAllister	124	174	87	25	136	46	134	107	102	77	78	90	105	111	78	44
Mud Bay	134	371	294	95	203	130	70	175	87	214	136	297	208	187	349	594
Oyster Cr. – Pigeon Pt.	474	542	293	157	331	314	190	344	121	51	39	14		6	226	75
Naselle River												184	115	37	42	292
Newaukum	634	167	335	309	219											
Potlatch	297	285	306	168	295	480	129	297	288	333	254	506	406	396	556	718
Red Salmon	179	103	64	33	107	41		0	47	5		93		43		180
Soda Springs									58	112		193	259	246	106	101
St. Martins	220	128	191	189	141	210	214	439	180	308	354	435	507	83	279	283
Sumas	46		68					78	17	82	74	78		96	152	64
U. Kalama	110	225	327	120	350	317	111	368	258	245	187	322	321	243	471	539
Totten -Oyster Bay							119	53	101	192	332	486	388	308	221	443
Warm Beach	48	58	62	83	36	29	29	72	10	60		33	223	57	16	
Willapa	3	24	10	3	0	5	5		2							
Uncorrected Totals	**2855**	**2577**	**2622**	**1585**	**2336**	**1915**	**1367**	**2213**	**1633**	**2226**	**2028**	**3214**	**3238**	**2350**	**3016**	**4098**

Table 3: WA band-tailed pigeon harvest report summary.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2002-18 AVE.
NUMBER OF PERMITS ISSUED	522	657	766	809	909	894	917	567	632	178	237	244	266	249	253	212	220	502
TOTAL DAYS	357	337	209	382	315	364	247	548	362	151	195	85	191	96	112	192	222	257
TOTAL HARVEST	273	574	383	492	569	661	434	776	381	205	196	129	172	72	94	183	198	341
HARVEST BY COUNTY																		
CLAL	37	35	14	25	35	37	5	0	39	0	0	6	0	0	0	0	0	14
CLAR	29	45	29	35	60	51	56	94	18	48	29	12	44	19	26	57	67	42
COWL	28	54	4	2	3	32	24	39	12	18	15	0	4	9	4	11	17	16
GRAY	47	53	104	76	71	145	103	129	83	47	55	26	55	2	18	31	50	64
ISLA	0	0	0	0	9	0	0	0	0	0	1	0	0	0	0	0	4	1
JEFF	10	16	31	26	14	29	6	4	6	3	0	0	2	0	0	0	0	9
KING	4	23	13	6	11	14	9	43	12	0	0	0	0	0	0	0	0	8
KITS	0	1	0	0	0	0	0	0	0	1	0	5	0	0	0	0	0	0
LEWI	7	13	11	34	5	22	13	19	15	0	1	0	1	1	5	9	4	9
MASO	26	38	48	62	63	84	59	126	19	2	2	0	18	1	6	4	0	33
PACI	13	21	37	35	73	80	82	136	56	1	47	33	6	6	0	22	18	39
PIER	20	82	30	62	85	63	32	85	43	14	34	42	36	28	28	34	34	44
SANJ	0	0	12	0	0	0	0	0	0	45	0	0	0	0	0	0	0	3
SKAG	33	99	15	97	74	65	31	30	42	3	2	2	3	2	0	4	2	30
SKAM	5	16	0	10	16	21	11	27	7	3	3	0	0	0	0	0	0	7
SNOH	15	29	3	12	11	3	4	4	10	13	2	0	1	0	0	3	0	6
THUR	0	13	8	2	24	10	0	5	13	7	0	0	0	2	6	0	2	5
WAHK	0	0	0	0	0	0	0	7	0	0	0	0	0	2	0	0	0	1
WHAT	0	34	24	6	14	4	0	28	6	0	5	3	2	0	0	5	0	8

Waterfowl

WATERFOWL: BREEDING POPULATIONS AND PRODUCTION STATUS AND TREND REPORT

STATEWIDE

MATTHEW T. WILSON, Statewide Waterfowl Specialist

Introduction

This report summarizes waterfowl productivity data collected during 2019 in Washington State, including information on breeding waterfowl populations, duck broods, and goose nest surveys. The 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.

Population Surveys

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 USFWS Pacific Flyway office formerly 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 6-10, 2019.

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 29–May 2, 2019.

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 2009-2012 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 duck counts numbered 194,092 (*SE* 14,672) within three eastern Washington strata (Table 4). Total mallards numbered 89,675 (*SE* 11,270). Gadwall was the second most numerous species on the survey (22,142, *SE* 4,132), followed by Cinnamon Teal (15,780 *SE* 3,008), Redhead (12,886 *SE* 3,838), and Northern shoveler (9,860 *SE* 2,805, Fig. 4).

The Potholes stratum comprised 63.0% of the total duck count in 2019, followed by the Irrigated stratum (20.2%) and the Highlands stratum (16.7%). Compared to the 2018 survey, 2019 total breeding duck counts decreased 12.0% in eastern Washington (Fig. 5, Table 4).

The revised survey design for western Washington estimated the total breeding duck population at 54,240 (*SE* 5,163). Mallards numbered 36,568 (*SE* 4,442), followed by wood duck 4,916 (*SE* 678), Green-winged teal (4,374 *SE* 2,060), and Gadwall (2,037 *SE* 1,059; Fig. 6, Table 5). The North Puget Lowlands stratum held the majority of breeding ducks in 2019 (45.7%), followed by the South Puget Lowlands (28.8%), Hood Canal (12.2%), Chehalis River Valley (7.6%), and Dungeness (5.8%; Fig. 7, Table 5).

Statewide, the total breeding duck counts decreased 11.7% compared to last year and are up 51.5% over the 3-year average. Mallards increased 1.1% (+50% 3-year average), American wigeon decreased 7.9%, but remain above the 3-year average (5.6%); gadwall decreased 14.9% (54% 3-year average). Wood ducks decreased 40.5% (+145% 3-year average) since last season (Fig. 8). Northern shovelers decreased 44.5% (+0.1%) but remain very high over the long-term (+107%), as well as Blue-winged teal (+645%), and ruddy ducks (+131%, Fig. 8). Decreases were again noted in Northern pintail (-60.8%0, +3% long term). However, bufflehead increased 17% over 2018 and green-winged teal increased 31.5% (6% long term). These sustained increases were driven largely by average snowpack and continued uncommon water abundance in eastern Washington.

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 brood survey is undergoing an evaluation to determine feasibility of sampling design, efficiency, and repeatability. For 2018 and 2019, staffing shortages and issues with observability reduced the survey effort and areas with limited data were averaged for comparisons to previous years under the current weighting factors. In 2019, the Potholes, Palouse, and Northeast strata remained within 1% of 2018 averages, and remains 14% below the long-term for all combined duck species (Fig. 9, Table 6). Brood production decreased 20% in the Okanogan strata and 2% in the Northeast, and as much as 42% in the Columbia Basin. The Channeled Scablands increased 15% but is still 65% below the long-term average. The Palouse stratum showed an increase of 27% compared to 2018 and is now only 4% below the long-term average (Table 7).

Canada Goose Breeding Population Survey

Methods

Canada goose breeding populations are indexed for 1974-2018 from nest searches conducted within four major geographic areas, mainly along the Snake and Columbia rivers (Table 8). Surveys were conducted annually, biennially, or periodically. The total number of goose nest attempts was used as an index of the goose breeding population, and surveys were focused on areas with high densities of nesting geese. Some areas with relatively recent goose population expansions were 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. Beginning in 2019, there were no ground-based nest searches conducted. The aerial index for breeding geese is being used to monitor breeding geese throughout Washington consistent with the extent of harvest management strategies considered for this population.

Results

The 2019 Canada goose breeding index decreased about 1% statewide compared to last year, remaining 23% above the 1974-2018 average. The total eastern Washington index decreased about 1.6% compared to last year, remaining 23% above the 1974-2018 average (Fig. 10, Table 9).

Nest indices remained unchanged in the upper Columbia (0%), and in the mid- Columbia (0%) due to variable year survey efforts. (Fig. 11, Fig. 12, Table 9). Counts have been carried over in any strata that was in a non-count year or due to access limitations. The lower Columbia section of this stratum is only surveyed every 5-years and was last surveyed in 2012. Therefore, counts from the previous year were used. Aerial breeding goose surveys replace the routine surveys intermittently conducted. Over 21 surveys were conducted according to the variable survey schedule. Most strata in the state are above their long-term averages (1974- 2017) with the exception of the Upper Columbia River stratum, which began a steep decline starting in 2003 (-9%, Fig. 11, Table 9).

The number of geese observed during the breeding duck surveys is presented in Figure 13 and Table 9. This index provides information about the expansion of Canada geese into areas of Washington outside of our traditional goose nest index areas, and in general, shows an increasing trend over the complete survey period.

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 to inform September season harvest strategies.

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.

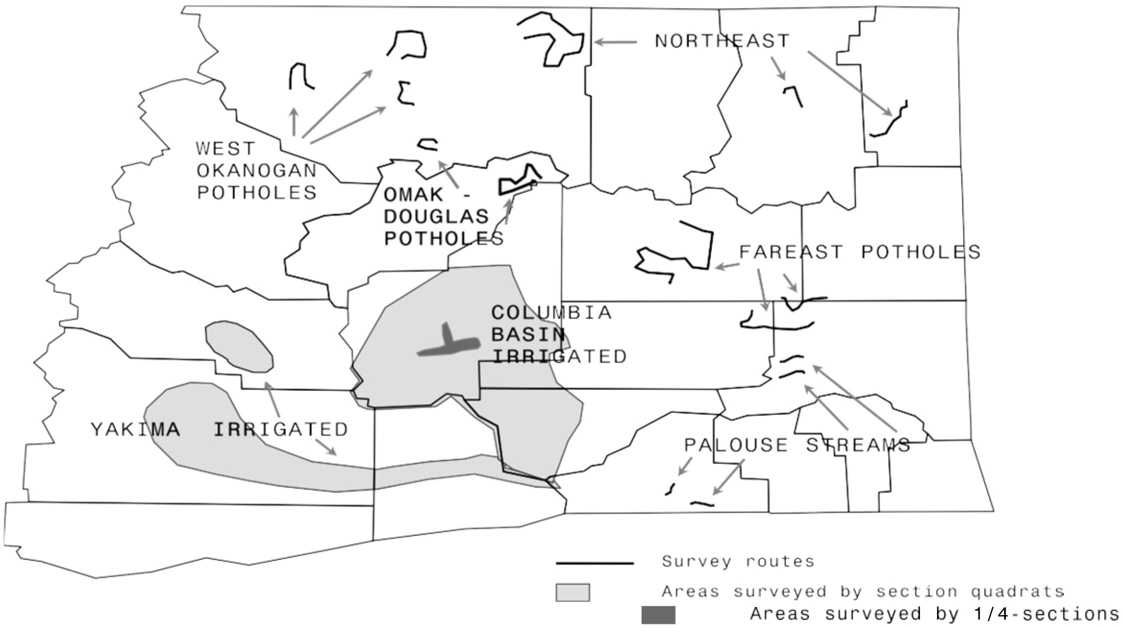


Figure 2. Eastern Washington aerial breeding waterfowl survey transects flown in 2019.

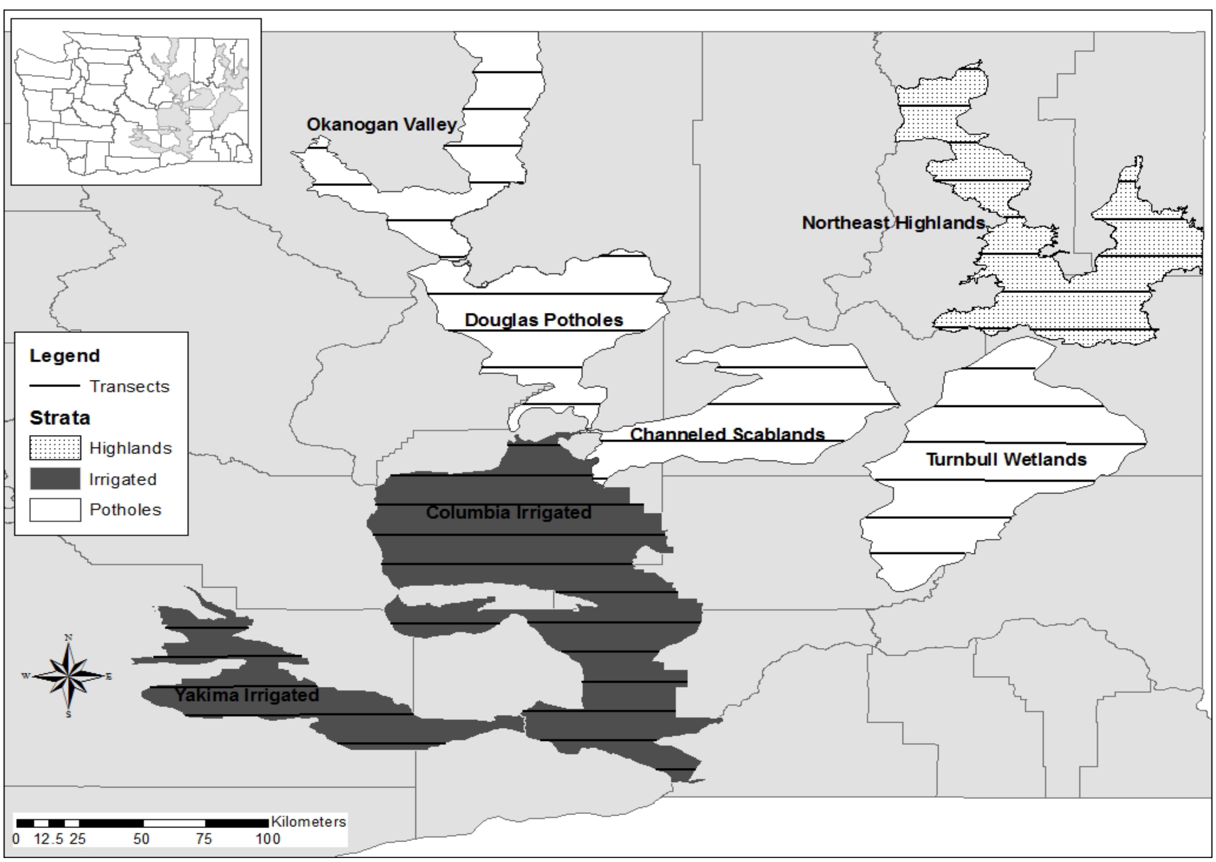


Figure 3. Western Washington aerial breeding waterfowl survey transects flown in 2019.

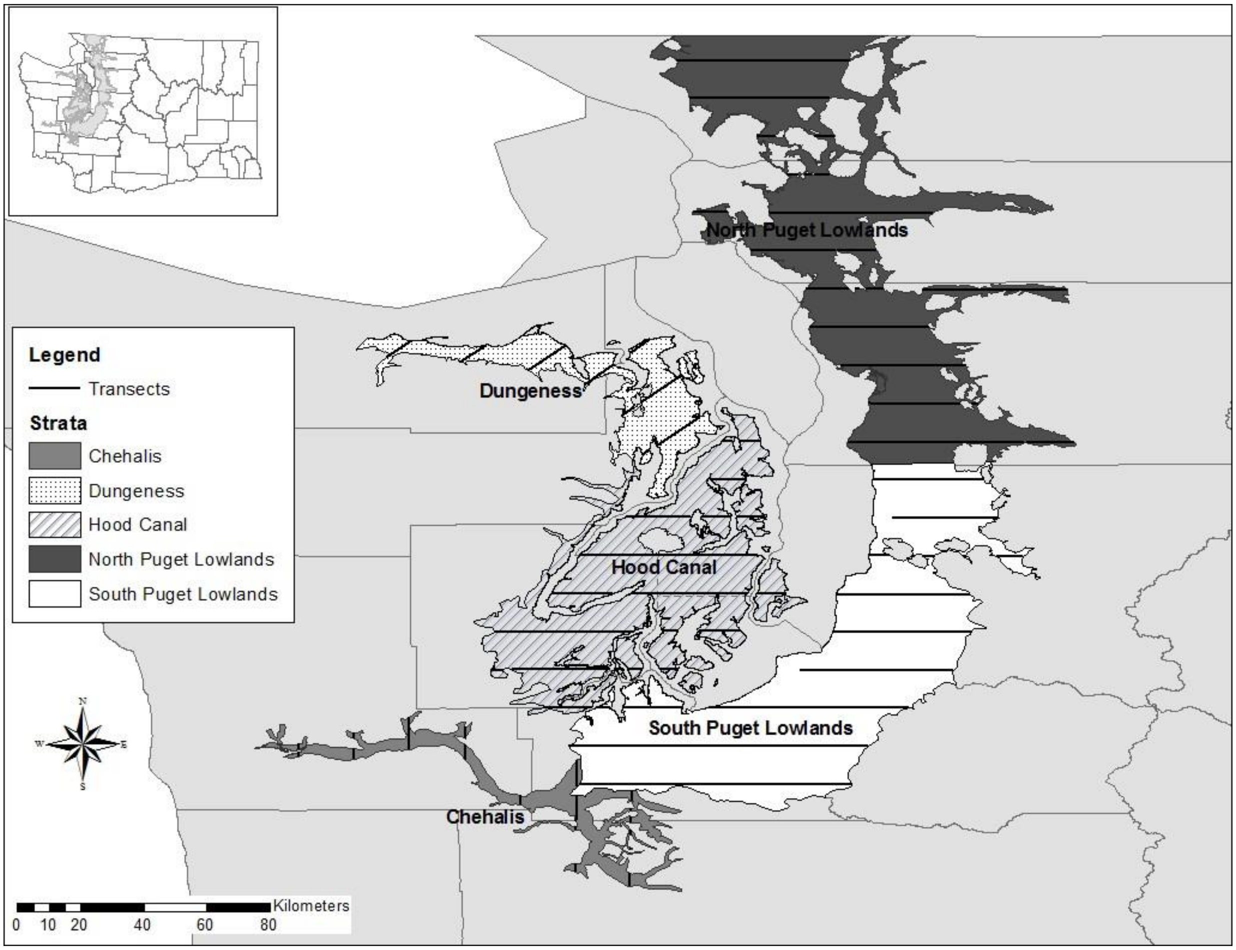


Figure 4. Eastern Washington duck breeding population survey results by species, 2014-2019.

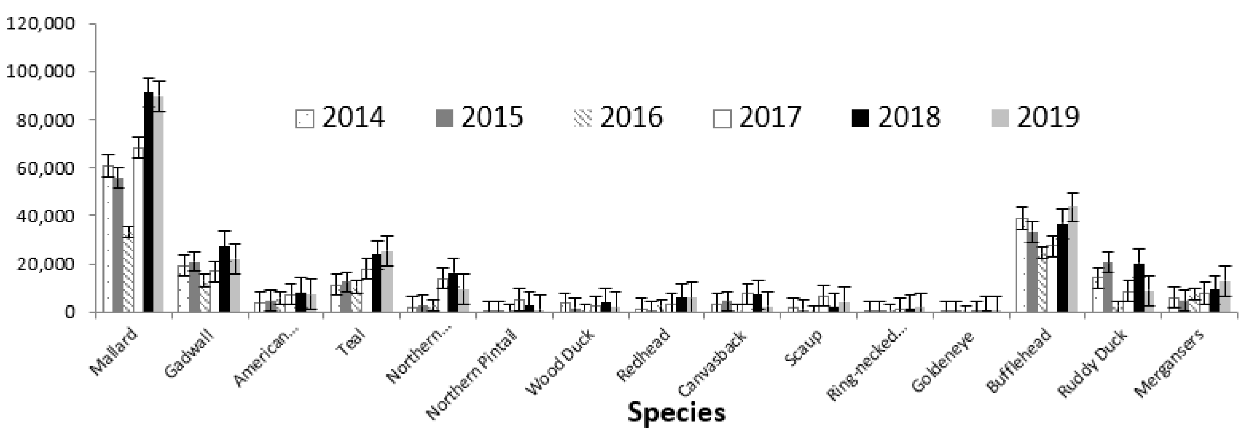


Figure 5. Eastern Washington duck breeding population survey results by species and strata, 2019.

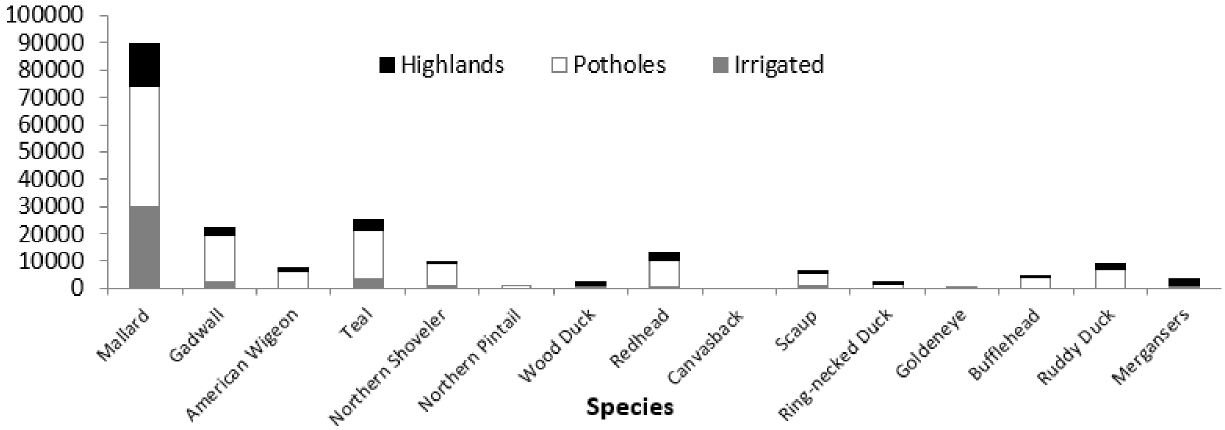


Figure 6. Western Washington duck breeding population survey results by species, 2010-2019.

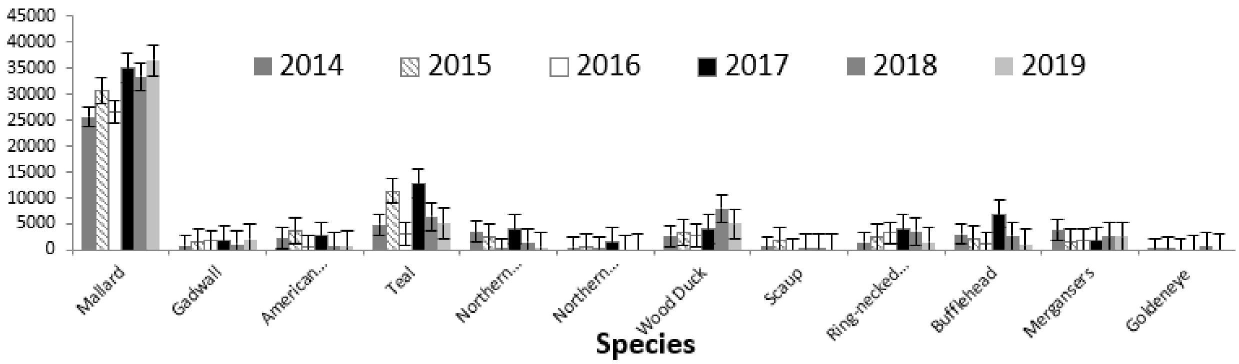


Figure 7. Western Washington duck breeding population survey results by species and strata, 2019.

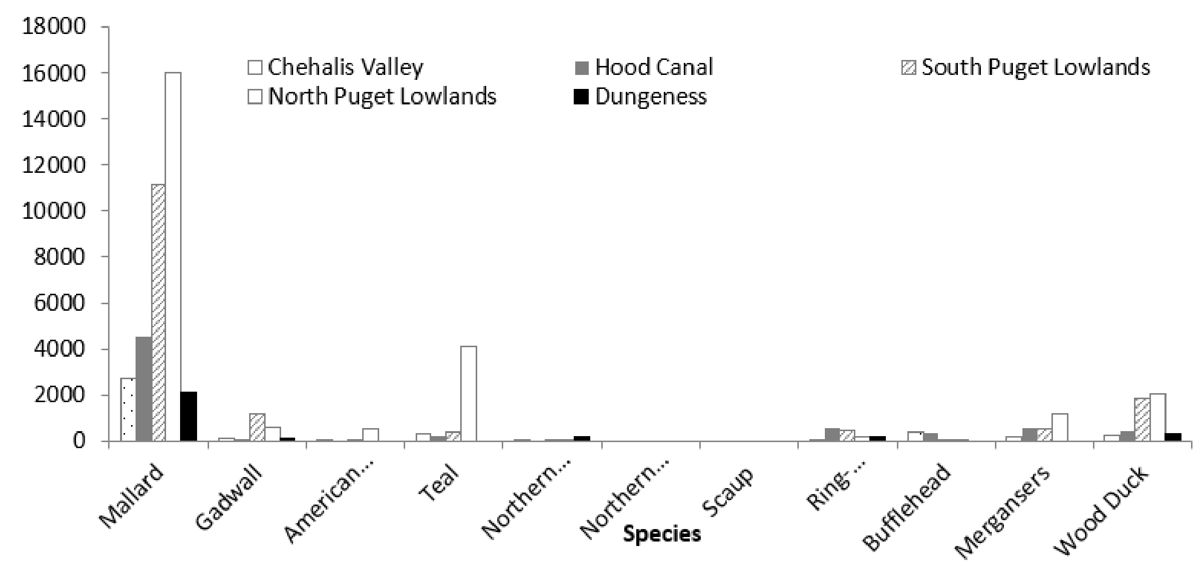


Figure 8. Statewide duck breeding population survey results by species, 2014-2019.

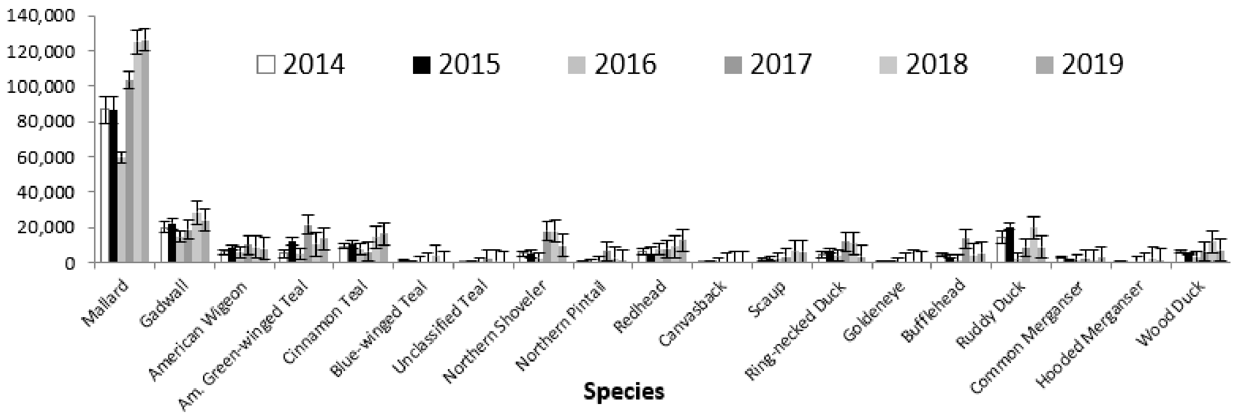


Figure 9. Brood index: Potholes, Palouse, Northeast Strata. 1979-2019.

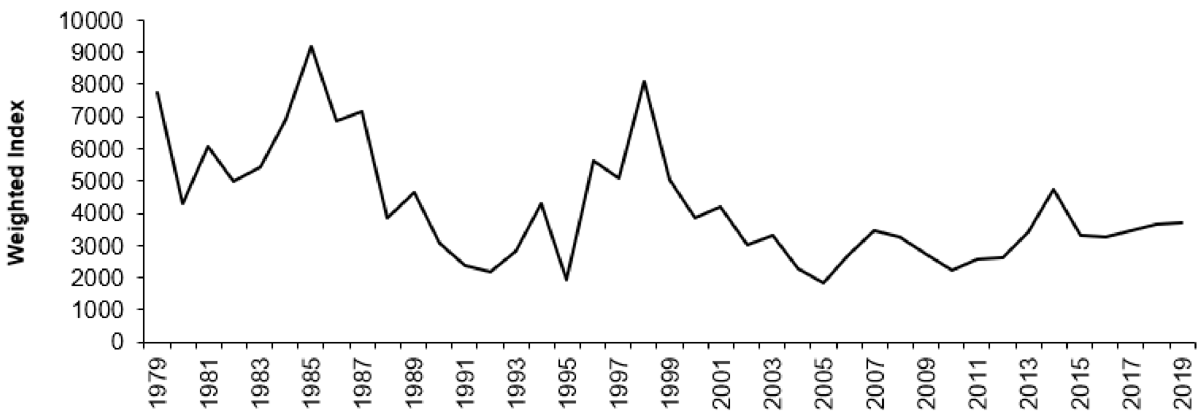
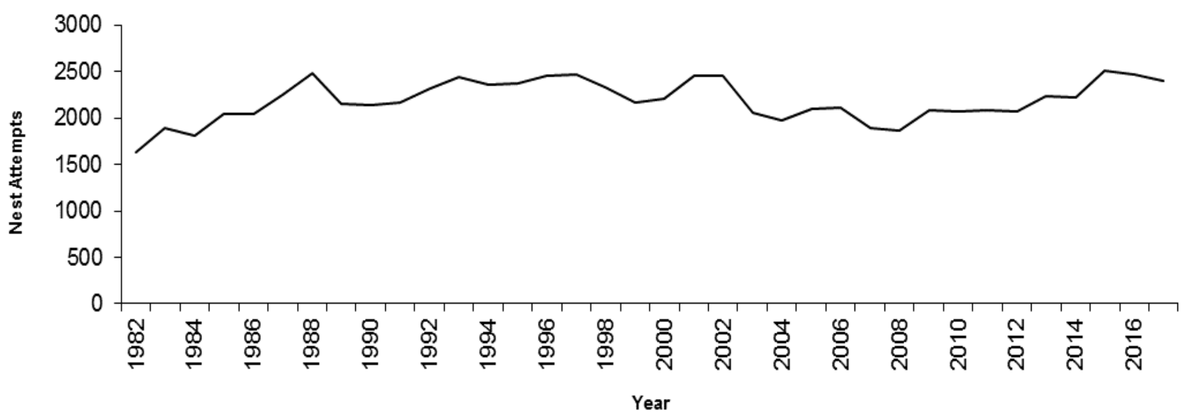


Figure 10. Total Canada goose nests counted in in eastern Washington, 1982-2019.



11. Canada goose nest survey trends in eastern Washington, 1985-2018. No counts in 2019. UCR = Upper Columbia River; MCR = Middle Columbia River; SR = Snake River; CB= Columbia Basin. goose nests counted in in eastern Washington, 1982-2019.

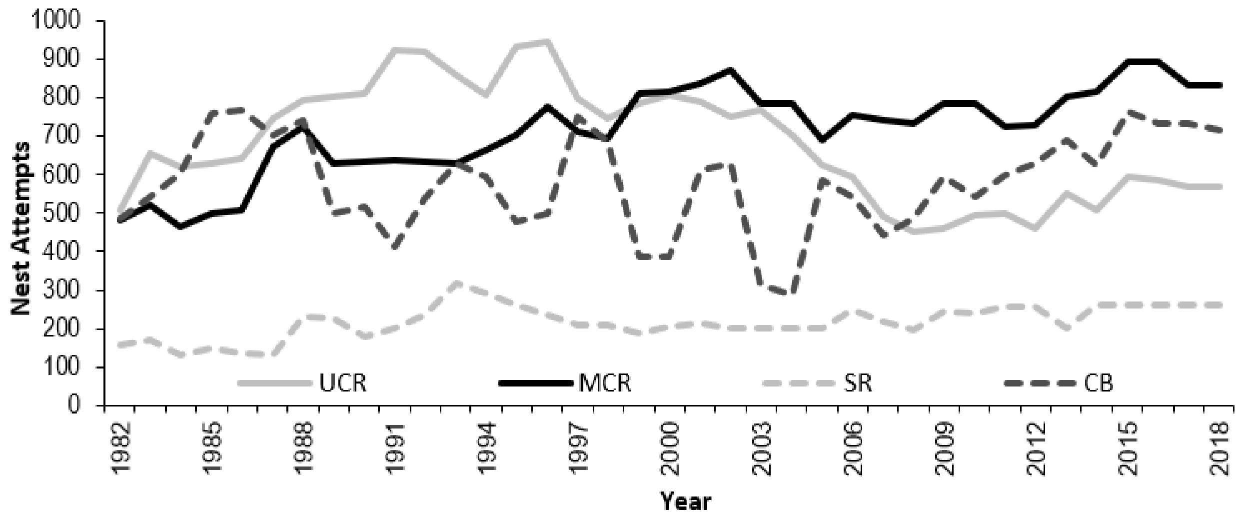


Figure 12. Total Canada goose nests in the lower Columbia River stratum, 1987-2018. No nest counts in 2019.

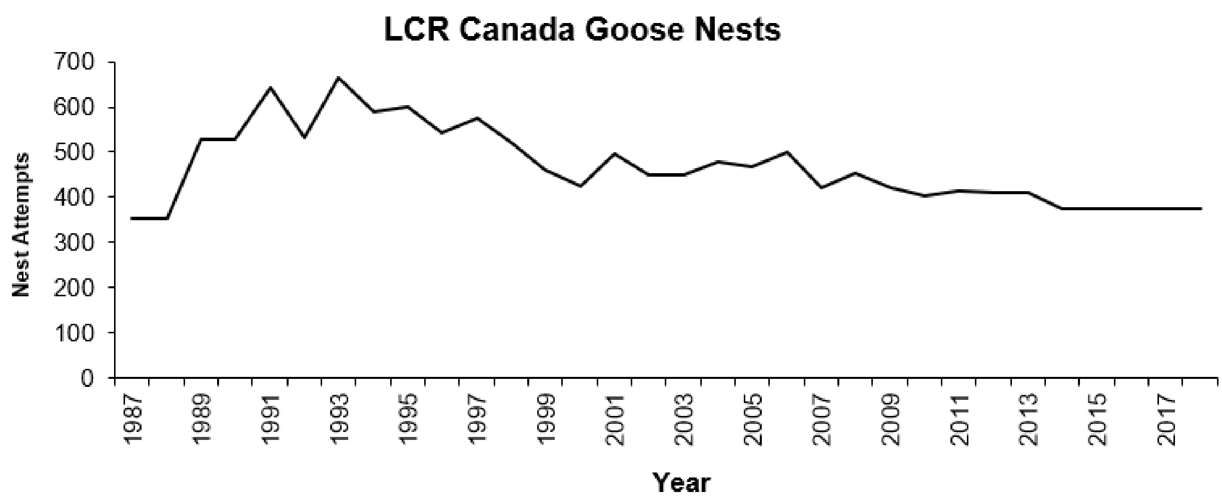


Figure 13. Breeding Canada goose index from breeding duck surveys, 1979-2011 historic, 2011-2019 aerial.

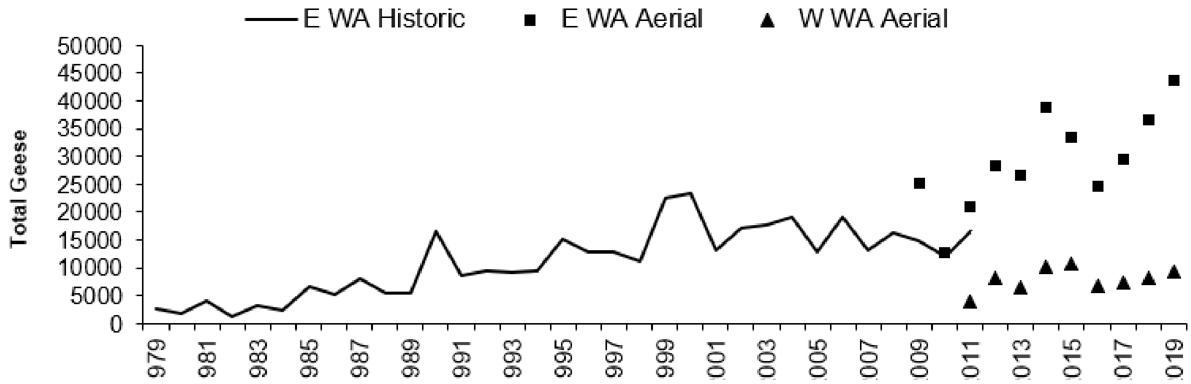


Table 1. Areas and subareas historically surveyed with weighting factors for pond indices, and duck and goose breeding surveys.

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 avg.	67204	58730	2812	21133	149834

Table 4. Summary of eastern Washington helicopter surveys for breeding waterfowl (2014-2019).

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
		Species																				
Irrigated	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	7,639
	±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*	*1,696*
	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	5,570
	±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*	*1,071*
	2016	15,406	3,024	509	828	2,228	382	796	127	1,305	0	859	191	0	64	32	0	0	382	**26,133**	2,515	3,024
	±SE	*2,145*	*683*	*175*	*333*	*456*	*137*	*529*	*69*	*838*	*0*	*373*	*87*	*0*	*54*	*25*	*0*	*0*	*165*	***2,569***	*1,348*	*1,010*
	2017	29,634	4,966	1,528	3,438	1,910	127	1,942	255	446	0	1,687	1,146	64	1,814	414	64	0	1,082	**50,515**	3,565	5,348
	±SE	*6,820*	*2,016*	*491*	*2,155*	*1,120*	*124*	*993*	*139*	*250*	*0*	*632*	*407*	*67*	*1,176*	*271*	*65*	*0*	*408*	***7,745***	*1,176*	*1,518*
	2018	32,351	4,966	668	1,241	3,310	509	1,337	0	700	0	1,432	796	64	64	0	477	0	987	**49,083**	3,438	8,913
	±SE	*6,425*	*1,691*	*247*	*591*	*1,223*	*295*	*613*	*0*	*494*	*0*	*687*	*507*	*62*	*62*	*0*	*303*	*0*	*394*	***6,909***	*2,625*	*2,113*
	2019	29,666	2,419	127	573	2,801	0	1,082	191	286	0	1,273	95	64	127	95	127	0	382	**39,311**	764	8,085
	±SE	*6,319*	*748*	*127*	*215*	*1,450*	*0*	*488*	*185*	*293*	*0*	*997*	*71*	*63*	*130*	*92*	*90*	*0*	*173*	***6,639***	*408*	*2,249*
Potholes	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	17,246
	±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*	*5,354*
	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	19,337
	±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*	*7,525*
	2016	12,940	7,359	4,878	1,612	4,382	0	1,984	331	4,837	0	1,571	207	0	0	1,323	165	0	165	**41,756**	9,343	12,403
	±SE	*1,823*	*1,478*	*2,662*	*690*	*1,068*	*0*	*463*	*193*	*1,654*	*0*	*1,102*	*135*	*0*	*0*	*596*	*120*	*0*	*107*	***4,337***	*3,477*	*3,962*
	2017	27,913	10,308	5,278	7,257	3,628	82	10,390	4,783	6,391	165	1,567	4,370	0	4,041	7,422	742	165	660	**95,160**	13,853	15,049
	±SE	*5,175*	*1,462*	*1,408*	*1,469*	*1,492*	*81*	*2,329*	*1,520*	*1,702*	*162*	*1,268*	*1,027*	*0*	*1,850*	*3,322*	*445*	*115*	*316*	***7,961***	*3,469*	*4,494*
	2018	44,323	20,574	6,679	5,896	9,236	412	11,916	2,721	7,380	247	4,288	5,937	0	1,690	19,832	247	247	1,690	**143,318**	27,583	17,647
	±SE	*6,087*	*4,248*	*1,726*	*967*	*1,888*	*335*	*3,461*	*759*	*1,966*	*131*	*2,150*	*1,567*	*0*	*1,055*	*17,068*	*191*	*184*	*768*	***19,475***	*7,187*	*7,127*
	2019	*44,240*	*17,028*	*6,143*	*8,040*	*9,730*	*247*	*8,164*	*907*	*10,143*	*0*	*4,247*	*1,361*	*82*	*3,670*	*6,968*	*577*	*247*	*577*	***122,372***	*17,069*	*24,491*
	±SE	*7,516*	*3,660*	*1,378*	*1,471*	*2,191*	*172*	*2,749*	*278*	*3,111*	*0*	*1,773*	*662*	*85*	*1,594*	*4,764*	*276*	*131*	*242*	***11,183***	*4,522*	*8,249*
Highlands	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	13,946
	±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*	*4,323*
	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	8,439
	±SE	*2,608*	*1,009*	*64*	*394*	*420*	*0*	*574*	*0*	*130*	*472*	*0*	*184*	*55*	*301*	*236*	*110*	*0*	*124*	***2,989***	*701*	*1,795*
	2016	4,884	2,541	318	0	874	0	0	0	1,271	0	159	476	79	0	913	556	0	318	**12,389**	1,112	9,252
	±SE	*1,132*	*868*	*130*	*0*	*263*	*0*	*0*	*0*	*809*	*0*	*78*	*240*	*49*	*0*	*638*	*325*	*0*	*140*	***1,837***	*464*	*3,151*
	2017	10,865	1,664	634	634	792	79	1,585	158	991	317	0	2,219	0	832	872	396	158	555	**22,742**	5,983	8,994
	±SE	*3,251*	*1,271*	*413*	*370*	*637*	*81*	*1,050*	*107*	*751*	*245*	*0*	*1,122*	*0*	*554*	*847*	*280*	*106*	*402*	***4,144***	*5,856*	*3,241*
	2018	14,620	1,823	792	911	2,060	158	3,170	79	1,228	0	396	555	158	238	317	79	357	1,268	**28,209**	4,913	10,103
	±SE	*3,274*	*1,038*	*463*	*397*	*773*	*149*	*2,376*	*81*	*671*	*0*	*403*	*318*	*161*	*156*	*170*	*71*	*280*	*520*	***4,426***	*4,253*	*4,102*
	2019	*15,769*	*2,694*	*1,189*	*792*	*3,249*	*0*	*238*	*0*	*2,456*	*0*	*555*	*792*	*0*	*674*	*1,823*	*872*	*79*	*1,228*	***32,409***	*2,536*	*11,173*
	±SE	*5,530*	*1,767*	*783*	*278*	*1,465*	*0*	*156*	*0*	*2,229*	*0*	*276*	*214*	*0*	*315*	*1,853*	*396*	*80*	*550*	***6,791***	*1,653*	*5,135*

Table 4. Summary of eastern Washington helicopter surveys for breeding waterfowl (2014-2019)(Continued)

Total - Eastern Washington	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	38,832
	±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*	*7,088*
	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	33,347
	±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*	*7,810*
	2016	33,230	12,924	5,705	2,440	7,484	382	2,780	458	7,413	0	2,589	874	79	64	2,268	721	0	865	**80,278**	12,970	24,678
	±SE	*3,034*	*1,845*	*2,671*	*766*	*1,191*	*137*	*704*	*205*	*2,023*	*0*	*1,166*	*289*	*49*	*54*	*873*	*346*	*0*	*241*	***5,365***	*3,758*	*5,162*
	2017	68,403	16,937	7,439	11,328	6,331	289	13,917	5,196	7,827	482	3,254	7,735	64	6,687	8,707	1,202	323	2,297	**168,417**	23,401	29,390
	±SE	*9,157*	*2,796*	*1,548*	*2,634*	*1,972*	*169*	*2,741*	*1,530*	*1,877*	*294*	*1,417*	*1,574*	*67*	*2,260*	*3,439*	*530*	*156*	*654*	***11,855***	*6,907*	*5,745*
	2018	91,473	27,362	8,140	8,049	14,606	1,080	16,422	2,800	9,309	247	6,117	7,288	222	1,992	20,149	804	604	3,945	**220,610**	35,934	36,662
	±SE	*9,437*	*4,688*	*1,804*	*1,201*	*2,379*	*470*	*4,242*	*764*	*2,135*	*131*	*2,293*	*1,677*	*173*	*1,069*	*17,069*	*365*	*335*	*1,007*	***21,133***	*8,754*	*8,491*
	2019	89,675	22,142	7,459	9,405	15,780	247	9,484	1,098	12,886	0	6,075	2,249	146	4,470	8,886	1,576	327	2,187	**194,092**	20,369	43,749
	±SE	11,270	4,132	1,590	1,513	3,008	172	2,796	334	3,838	0	2,053	976	106	1,630	5,113	491	153	626	**14,672**	4,832	9,974

Table 5. Summary of western Washington breeding waterfowl population survey (2014-2019).

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
		Species																					
Chehalis Valley	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*
	2016	2,014	258	155	929	0	0	0	0	0	0	0	0	129	0	52	0	310	0	361	**4,208**	0	258
	±SE	*1,015*	*248*	*149*	*893*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*65*	*0*	*42*	*0*	*313*	*0*	*231*	***1,439***	*0*	*154*
	2017	2,866	103	258	3,253	0	0	2,194	2,530	955	0	0	0	929	0	1,058	0	52	0	568	**14,766**	0	181
	±SE	*672*	*107*	*204*	*1,806*	*0*	*0*	*1,562*	*1,710*	*918*	*0*	*0*	*0*	*263*	*0*	*499*	*0*	*52*	*0*	*126*	***3,211***	*0*	*110*
	2018	2,891	207	207	336	52	361	52	929	0	0	0	207	929	0	258	0	52	52	310	**6,841**	0	1136
	±SE	*888*	*149*	*157*	*208*	*50*	*347*	*50*	*755*	*0*	*0*	*0*	*234*	*504*	*0*	*42*	*0*	*42*	*52*	*98*	***1,377***	*0*	*355*
	2019	2,139	119	0	119	0	0	0	178	0	0	0	0	208	0	0	0	0	0	297	**3,060**	0	1188
	±SE	*606*	*128*	*0*	*128*	*0*	*0*	*0*	*192*	*0*	*0*	*0*	*0*	*70*	*0*	*0*	*0*	*0*	*0*	*170*	***686***	*0*	*903*
Hood Canal	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*
	2016	3,963	0	63	0	0	0	0	0	0	0	0	0	412	0	507	0	0	190	285	**5,422**	63	666
	±SE	*458*	*0*	*65*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*194*	*0*	*261*	*0*	*0*	*121*	*116*	***590***	*61*	*358*
	2017	4,159	0	347	0	0	0	0	0	0	0	0	0	662	0	819	0	63	126	441	**6,617**	0	284
	±SE	*922*	*0*	*354*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*302*	*0*	*427*	*0*	*63*	*141*	*132*	***1,136***	*0*	*198*
	2018	6,217	64	157	208	0	0	0	0	0	0	0	0	446	64	128	0	64	765	2,200	**10,074**	0	1116
	±SE	*958*	*58*	*128*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*298*	*63*	*120*	*0*	*63*	*271*	*596*	***1,216***	*0*	*398*
	2019	4,521	64	0	64	0	0	0	0	0	0	0	0	542	0	351	0	64	510	446	**6,631**	0	797
	±SE	*785*	*63*	*0*	*61*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*268*	*0*	*212*	*0*	*63*	*184*	*185*	***904***	*0*	*333*
Dungeness	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*
	2016	2,228	475	0	891	178	0	0	0	0	0	0	0	564	0	0	0	0	59	0	**4,397**	0	683
	±SE	*777*	*393*	*0*	*847*	*132*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*269*	*0*	*0*	*0*	*0*	*61*	*0*	***1,252***	*0*	*440*
	2017	1,961	59	238	178	0	0	0	0	0	0	0	0	267	0	178	0	59	0	297	**3,238**	0	208
	±SE	*790*	*64*	*129*	*182*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*176*	*0*	*123*	*0*	*61*	*0*	*109*	***860***	*0*	*116*
	2018	1,872	59	0	267	0	2,377	0	0	0	0	0	0	208	59	0	0	0	0	475	**5,317**	0	386
	±SE	*592*	*61*	*0*	*137*	*0*	*2,430*	*0*	*0*	*0*	*0*	*0*	*0*	*114*	*57*	*0*	*0*	*0*	*0*	*298*	***2,526***	*0*	*383*
	2019	2,139	119	0	119	0	0	0	178	0	0	0	0	208	0	0	0	0	0	297	**3,060**	0	1188
	±SE	*606*	*128*	*0*	*128*	*0*	*0*	*0*	*192*	*0*	*0*	*0*	*0*	*70*	*0*	*0*	*0*	*0*	*0*	*170*	***686***	*0*	*903*
South Puget Lowlands	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*
	2016	9,962	484	363	61	182	0	30	61	0	0	0	0	1,998	0	545	0	121	242	1,029	**15,079**	30	3179
	±SE	*1,271*	*266*	*344*	*57*	*140*	*0*	*33*	*63*	*0*	*0*	*0*	*0*	*789*	*0*	*256*	*0*	*68*	*100*	*336*	***1,627***	*33*	*637*
	2017	11,874	0	182	1,458	0	0	0	182	0	0	0	0	2,156	0	2,976	0	182	121	1,033	**20,165**	61	3189
	±SE	*1,576*	*0*	*128*	*690*	*0*	*0*	*0*	*127*	*0*	*0*	*0*	*0*	*1,700*	*0*	*1,193*	*0*	*169*	*113*	*223*	***2,719***	*56*	*1330*
	2018	12,190	363	121	0	60	60	907	363	0	0	0	60	1,633	0	1,422	0	302	423	3,267	**21,174**	60	3509
	±SE	*1,295*	*222*	*124*	*0*	*56*	*57*	*585*	*211*	*0*	*0*	*0*	*62*	*978*	*0*	*763*	*0*	*169*	*212*	*1,234*	***2,296***	*56*	*531*
	2019	11,159	1,152	61	121	243	0	0	61	0	0	0	0	425	0	61	0	243	243	1,850	**15,617**	0	3396
	±SE	*1,152*	*998*	*62*	*124*	*256*	*0*	*0*	*62*	*0*	*0*	*0*	*0*	*225*	*0*	*63*	*0*	*193*	*106*	*431*	***2,200***	*0*	*792*
North Puget Lowlands	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*
	2016	8,467	419	60	449	299	0	0	0	359	0	0	0	90	0	180	0	658	120	987	**12,087**	0	2005
	±SE	*419*	*268*	*60*	*251*	*310*	*0*	*0*	*0*	*301*	*0*	*0*	*0*	*64*	*0*	*122*	*0*	*494*	*73*	*376*	***2,427***	*0*	*673*
	2017	14,121	1,526	1,556	5,266	60	239	0	1,137	419	0	0	120	60	0	1,915	0	898	120	1,556	**28,991**	180	3411
	±SE	*2,682*	*828*	*1,012*	*3,207*	*61*	*157*	*0*	*842*	*359*	*0*	*0*	*122*	*62*	*0*	*653*	*0*	*469*	*79*	*320*	***4,563***	*130*	*1695*
	2018	10,292	359	180	1,825	60	60	0	60	0	0	0	60	419	479	778	0	180	598	1,735	**17,083**	0	2184
	±SE	*2,734*	*259*	*183*	*820*	*58*	*62*	*0*	*62*	*0*	*0*	*0*	*60*	*330*	*317*	*350*	*0*	*75*	*196*	*438*	***2,971***	*0*	*559*
	2019	16,006	598	509	3,889	239	0	0	60	0	0	0	0	180	0	60	0	957	239	2,064	**24,802**	0	3800
	±SE	*3,664*	*318*	*336*	*2,047*	*248*	*0*	*0*	*56*	*0*	*0*	*0*	*0*	*83*	*0*	*61*	*0*	*573*	*119*	*448*	***4,295***	*0*	*905*
Total - Western Washington	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	**61,668**	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*
	2016	26,634	1,637	641	2,330	659	0	30	61	359	0	0	0	3,194	0	1,283	0	1,089	612	2,664	**41,192**	94	6791
	±SE	*2,935*	*599*	*385*	*1,258*	*365*	*0*	*33*	*63*	*301*	*0*	*0*	*0*	*861*	*0*	*388*	*0*	*589*	*183*	*566*	***3,539***	*69*	*1097*
	2017	34,981	1,689	2,580	10,154	60	239	2,194	3,849	1,374	0	0	120	4,074	0	6,947	0	1,254	367	3,894	**73,777**	240	7272
	±SE	*3,406*	*838*	*1,106*	*3,749*	*61*	*157*	*1,562*	*1,910*	*986*	*0*	*0*	*122*	*1,756*	*0*	*1,515*	*0*	*509*	*197*	*444*	***6,369***	*141*	*2169*
	2018	33,462	1,052	635	2,428	172	2,858	959	1,352	0	0	0	327	3,636	602	2,585	0	597	1,839	7,987	**60,490**	60	8331
	±SE	*3,348*	*382*	*300*	*857*	*95*	*2,456*	*587*	*786*	*0*	*0*	*0*	*249*	*1,192*	*328*	*849*	*0*	*200*	*400*	*1,472*	***4,884***	*56*	*1013*
	2019	36,568	2,037	621	4,374	546	0	103	376	0	0	0	0	1,406	0	884	0	1,367	1,044	4,916	**54,240**	0	9310
	±SE	*4,442*	*1,059*	*345*	*2,060*	*362*	*0*	*117*	*227*	*0*	*0*	*0*	*0*	*371*	*0*	*458*	*0*	*613*	*249*	*678*	***5,163***	*0*	*1542*

Table 6. Weighted duck brood indices by species for the Potholes, Palouse, and Northeast strata, 2004-2019.

Species	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	79-18 Avg	% change from 2018	% change from Average
Mallard	1284	1221	1200	1786	1419	1416	1035	1042	966	1597	2706	1017	1812	1620	1750	1781	1639	2%	9%
Gadwall	116	15	107	132	292	87	87	379	274	284	204	383	255	281	281	281	359	0%	-22%
Wigeon	95	146	54	54	48	43	10	35	26	26	0	0	26	15	26	15	232	-42%	-94%
Green-winged teal	14	26	118	94	151	183	176	233	272	244	204	179	51	190	174	160	152	-8%	5%
Blue-winged teal	92	26	15	0	42	48	0	30	47	101	26	51	26	51	51	47	493	-8%	-90%
Cinnamon teal	24	40	14	103	91	14	138	30	82	0	13	102	0	39	39	39	89	0%	-56%
Northern shoveler	63	0	29	15	59	44	49	19	19	19	0	25	0	12	19	19	149	0%	-87%
Northern pintail	20	0	0	0	0	0	0	0	14	0	0	0	0	14	14	0	108	-100%	-100%
Wood duck	42	33	82	107	28	28	42	33	112	141	153	77	255	148	155	158	45	2%	248%
Redhead	40	0	121	211	252	154	94	184	210	205	383	383	204	277	290	307	395	6%	-22%
Canvasback	26	15	65	26	90	0	32	0	77	14	51	51	0	39	39	39	33	0%	19%
Scaup	0	0	20	14	21	94	17	34	0	26	102	76	26	46	55	61	46	11%	33%
Ring-necked duck	85	0	108	26	50	14	86	23	14	26	51	77	0	34	38	41	47	8%	-13%
Goldeneye	266	163	438	444	412	331	275	391	231	138	332	255	204	232	232	251	180	8%	39%
Bufflehead	0	26	0	40	14	24	43	14	26	179	0	0	0	41	41	14	16	-66%	-14%
Scoter	0	0	0	0	0	0	0	0	0	26	0	0	0	26	26	13	6	-50%	104%
Ruddy duck	86	110	201	222	219	183	104	86	218	298	332	492	179	304	321	326	221	2%	48%
Merganser	15	0	128	204	77	77	65	56	40	82	102	154	204	116	132	142	51	8%	178%
TOTAL BROODS	3166	1819	4085	3477	3265	2741	2253	2588	2626	3402	4749	3322	3242	3468	3637	3684	4263	1%	-14%

Table 7. Weighted duck brood indices for E. Washington strata and total unweighted brood counts for 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	No survey
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
2016	859	787	868	195	2709	13
2017	690	860	895	176	2341	14
2018	635	1179	911	132	2764	36
2019	728	942	891	168	2605	21
LTA	2063	940	895	175	4053	115
2019 vs. 2018	**15%**	**-20%**	**-2%**	**27%**	**-6%**	**-42%**
2019 vs. LTA	**-65%**	**0%**	**0%**	**-4%**	**-36%**	**-82%**

Table 8. 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 9. Number Canada goose nest counted per region (1974-2018), and total Canada geese observed on duck surveys. * 2019 was first year with no goose nest counts conducted from the ground.

	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
2016	584	263	891	731	2469	376	2845		24678	6791
2017	567	263	833	731	2394	376	2770		29390	7272
2018	567	263	833	717	2380	376	2756		36662	8331
2019	*	*	*	*	*	*	*	**2019 Aerial**	**43749**	**9310**
2018 vs. 2017	0%	0%	0%	-2%	-1%	0%	-1%	**2019 vs. 2018**	19%	12%
Long Term Avg.	623	194	643	561	1927	402	2265	LTA	27697	7743
2018 vs. LTA	-9%	36%	30%	28%	24%	-6%	22%	**2018 vs. LTA**	58%	20%

WATERFOWL: WINTER POPULATIONS AND HARVEST STATUS AND TREND REPORT

STATEWIDE

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Introduction

This report summarizes the 2018-19 Washington winter waterfowl surveys, hunting regulations, harvest, and hunter trends. This summary compares current data with data collected over the past 35 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

Traditionally, the primary assessment to determine status of wintering waterfowl throughout the Pacific Flyway was the January Midwinter Waterfowl Survey (MWS). This was 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 combined efforts among several agencies; Oregon Department of Fish and Wildlife (ODFW), California Department of Fish and Wildlife, Yakama Nation, U.S. Fish and Wildlife Service (USFWS), and Canadian Wildlife Service. WDFW continues to conduct a portion of the MWS in Washington.

WDFW also conducts special winter surveys focused on sea ducks during December and January, initially 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 subsequent year (except for 2006-07 and 2017-18, 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 6,400-7,100 km of transects. Population estimates from these surveys represent minimum estimates as observers are not able to detect all birds present within the transect, 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 when feasible. 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

As of 2016, the USFWS discontinued the Pacific Flyway MWS for total waterfowl (Fig. 1) Changes in operational priorities for USFWS created the need for states to conduct surveys individually, leaving Washington, California, and Montana as the only Pacific Flyway states to conduct portions of these original midwinter surveys.

WDFW suspended mid-winter surveys in January 2018. In western Washington, WDFW staff conducted a winter count of Willapa Bay, and focused efforts on an expanded snow goose, swan, and brant counts. In eastern Washington, Yakama Nation personnel conducted a partial survey of the Yakima Basin survey in January 2019, however, due to staffing shortages, results are pending. The statewide midwinter index for total waterfowl from 2007-2018 is in Table 1.

Ducks--In Washington, the most recent 10-year average for total wintering duck population was 639,930, but this value does not account for declining effort in certain regions of the state, for example 2018 included a limited number of sites traditionally surveyed, 155 in western Washington, but was 43% below the most recent 10-year average (Fig. 2). Traditionally, the Washington total duck count has represented 13.5% of the 10-year average from 2005-15 (Fig. 3). The 1991 MWS represents the highest proportion of Washington ducks to total Pacific Flyway (28.6%).

The most recent 10-year average for total number of mallards counted in Washington was 297,666, and on average comprises 47% of the total duck composition in Washington (Table 1). Washington typically holds a high percentage of the Pacific Flyway mallard population with a year average from 2005-15 of 41% (Fig. 4).

Results for special Puget Sound winter surveys through 2017 are presented in Table 2. Eleven species of sea duck are regularly recorded during these surveys with bufflehead (60,931), surf scoter (41,520), common goldeneye (20,184), Barrow’s goldeneye (14,951), white-winged scoter (14,602), and red-breasted merganser (14,453) representing the six most abundant based on the most recent 3-year averages. The most recent 3-year average for all three species of scoters is 57,005, which represents a 47% decline in total scoters in the Puget Sound compared to the 1994-96 peak average of 107,214.

Canada geese--Canada geese are 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 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 most recent 10-year average of total Canada geese is 39,498, but there continues to be high variability in annual counts (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 almost exclusively on Wrangel Island, Russia. Juvenile snow geese comprised 20.6% of the wintering population in the

Fraser and Skagit River Deltas in December 2018. MWS snow goose aerial photo counts by WDFW in late December numbered 109,993. This represents the single highest winter count recorded for this flock and brings the 3-year average for adult geese to 76,522, above the identified higher threshold for the first time (Table 3, Fig. 6). Reports from the Wrangel Island Tundra River colony indicated exceptionally above-average juvenile recruitment and survival in 2019.

Brant—At the time of this publication, the number of brant counted in Washington during the 2018 midwinter survey was 8,194, a 35.2% decrease from 2017, remaining nearly 46.8% below the 10-year average, but does not include final counts for Clallam and Whatcom counties (Table 1, Fig. 7). The number of brant counted at Willapa Bay during the ground-based winter survey was 2,991, an increase of 57% from 2017. The number of brant counted during the northern Puget Sound midwinter aerial survey on December 31, 2018 was 5,203, an increase of 8.5% from 2017. The largest concentrations of brant were in Lummi, Padilla, and Samish bays. Since 2006, breast feather color measurements taken from brant at Skagit County check stations show an annual gray-bellied (WHA = Mansell 4-8) composition between 21% to 79%.

Swans--The 2018 northern Puget Sound (Skagit, Whatcom, Snohomish, King, and Island counties) trumpeter swan MWS totaled 14,833 (Table 3), a 14% decrease from the 2017 count of 17,373, but was a much milder winter compared to 2017. Juveniles accounted for 12.1% of the trumpeter swans observed (Table 3). The western Washington total trumpeter swan midwinter index was 15,410, which does not include a final count from Clallam County, and there were a total of 975 swans that could not be speciated.

The 2018 northern Puget Sound tundra swan midwinter index was 1,560, increasing 40% from the 2017 index (929). Juveniles represented 8.5% of the population (Table 3). Total tundra swan midwinter index was 2,068, or 8.4% above the long-term average of 1,908.

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 discouraged swans from using the lake, which 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. However, known trumpeter swan mortalities increased to 374 in 2014-15 with 203 (54%) showing signs of lead poisoning. This prompted a revamping of the exclusion area in November 2016. Winter 2018-19 represented the second post-revamp year related to monitoring efforts and resulted in 396 encountered mortalities in the long-term monitoring region (n=356) and other counties (n=40), of which 179 (46%) were confirmed lead poisoning, but with 106 (27%) undetermined-cause mortalities. Monitoring of mortality cause and source of lead exposure in gizzard and liver samples will be continued to be documented and spatial extent mapped.

Periodic Aerial Survey Results

Aerial waterfowl surveys in northern Puget Sound were suspended due to WDFW staff turnover and emphasis was placed on training observers. A flight of Willapa Bay was conducted by WDFW staff. Surveys in the Columbia Basin were previously conducted cooperatively between WDFW and Yakama Nation biologists. These surveys are no longer conducted due to changes in funding and waterfowl survey design throughout the Pacific Flyway (Table 3).

Willapa Bay—The Willapa Bay January 2019 aerial survey totaled 8,287 dabbling ducks and 558 diving and sea ducks, but with an additional 1,454 unidentified ducks. These values do not account for detectability and should be considered an uncorrected index. The average January winter dabbling duck count for this area is 5,962 (1981-2002). Mallard are the most prevalent duck species with 4,801 (58% of all dabbling ducks) counted. Willapa Bay consistently supports higher numbers of dabbling ducks dominated by American wigeon during migration periods, however mallard are consistently the highest proportion of the winter count.

Eastern Washington—Results of other periodic surveys in the Columbia and Yakima basins, if available, 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 9,338 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. It is thought the very low counts in 2014 and 2015 are a 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. Surveys were not conducted in 2016 and were incomplete in 2017. It is not known at this time where these populations may have shifted and strategies for assessing this change are being considered.

Hunting Season Regulations

The 2018-19 waterfowl harvest was regulated under Washington State regulations following federal framework recommendations (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. 22-23 in western Washington and Sept. 29-30 in eastern Washington. The daily bag-limit was 7 ducks, to include not more than 2 hen mallard, 2 pintail, 3 scaup, 2 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).

Relatively stable and robust 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 with the 2014-15 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 $17.00 in 2015, and has remained through the 2018-19 season. 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 $13.20 migratory bird authorization to obtain harvest record cards for these species (harvest record cards were free before then). The federal migratory bird stamp increased to $25.00 in 2015 (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 was at 6 for 2018-19, with Area 2 being divided into Coast and Inland to allow for differential seasons dates to accommodate differences in distribution and opportunity related to Cackling goose subspecies (Fig. 9). Additionally, this zone adjustment required SW Canada Goose hunters to record the number of geese taken on the mandatory harvest report card.

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 Canada 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 greater recreational opportunity. Significant changes to the SW goose season in 2015-16 began with the closure of dusky Canada goose hunting. Check stations were expensive to operate, and it was believed that significant numbers of hunters failed to report to check stations. Other major changes included; more season days and longer hunting hours, elimination of harvest recording, hunting hours extended to 30 minutes after official waterfowl hunting hours to 30 minutes before the end of official waterfowl hunting hours, and the inclusion of Clark and Grays Harbor counties in permit zones 2A and 2B, respectively. Historic season regulations for SW Washington are presented in Table 6. A special late season addressing agricultural depredation concerns initiated in 1995-96 was continued in Area 2A and initiated in Area 2B during 2015-16. Beginning in 2016-17 Area 2A and 2B were combined into Area 2. For 2018-19, Area 2 was divided into Coast (including Pacific County and the portion of Grays Harbor County west of highway 101) and Inland (including Clark, Cowlitz, and Wahkiakum Counties, and the portion of Grays Harbor County east of highway 101). The season was open everyday Oct. 13-28 and Saturdays, Sundays and Wednesdays during Nov.3 – Dec.2, Dec. 22- Jan. 20 and Feb 2-16 in the Coast portion of Area 2. For the Inland portion, season was open everyday Oct. 13 – 28, Saturday Sunday, and Wednesday only during Nov. 24 – Jan. 13 and Feb. 9 – Mar. 9 open to all hunters possessing the SW goose authorization. Public lands remained closed during the late season segments in both areas. Beginning with the 2015-16 season, the Aleutian goose daily bag limit was eliminated, and Aleutians could be hunted as part of the normal Canada goose limit. 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. Daily bag limits and possession limits during the September goose season were 5 and 15, respectively, for the Coast and Inland zones to address a localized goose management consideration.

Agricultural depredation by snow geese in Skagit County led to the development of the Snow Goose Quality Hunt Program on Fir Island. Presently, 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 the remainder of the current waterfowl season and the subsequent season.

The January-only brant season took place in 2019, with 10 hunt days in Pacific County, 3 days in Clallam and Whatcom Counties, and 3 days in Skagit County (Table 4). The Skagit County brant hunt is dependent on a pre-season count of at least 3,000 brant, allowing a 3-day season, or more than 6,000 brant, allowing an 8-day season. On December 31, 2018, the Skagit County Aerial Photo Count estimated 5,203 brant. The shortened 3-day season in Skagit County was allowed to proceed as scheduled.

Harvest Surveys

Methods

Harvest estimates were traditionallybased 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 over 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. This survey was discontinued in 2017, and instead emphasis has been placed on sending a minimum of 3 biologists to participate in the Pacific Flyway Wingbee to assist in species, age and sex composition information that allows for incorporation into state-specific estimates. This has the added benefit of providing better training for personnel that participate in operational pre-season duck banding efforts each year.

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. Harvest reports returned by the deadline are included in the analysis as the ‘first wave’ of respondents. Reminder notices are sent out to hunters with email addresses available, reminding them to return reports. Responses received after the reporting deadline are included as the ‘second wave’, and then the harvest estimates are computed accounting for non-response bias. Hunters were required to report harvest by species and county with mandatory harvest report cards by March 20, 2019.

The harvest of dusky Canada was closed beginning with the 2015-16 season in Goose Management Area 2 during October through March (see above) in agreement and coordination with ODFW and USFWS. With removal of check stations, law enforcement checked hunter bags in Area 2 in order to determine compliance and were assisted by WDFW personnel specifically trained in determining goose species. WDFW uses standardized criteria for classifying duskys, where a dusky was classified as a dark-breasted Canada goose (Munsell ≤5) with a culmen length of 40-50 mm.

WDFW continued enhanced goose hunter training for people who wish to hunt geese in Area 2. The training program was initially developed in 1996 and revised in 1997 in conjunction with ODFW. In this program, hunters study a goose identification workbook and are advised to view a training video. 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 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. The test was updated in 2015 to reflect the dusky Canada goose season closure. And prior to the 2017-18 season the online test was modified to make it easier for hunters to purchase their license upon successfully passing the identification test. If a hunter takes a dusky Canada goose, or does not comply with field check requirements, the authorization will be invalidated, and the hunter is not allowed to hunt geese in Goose Management Area 2 Coast or Inland for the remainder of that waterfowl season.

Waterfowl Harvest Survey Results

The 2018-19 Washington duck harvest of 380,726 was 14% lower than the 2017-18 harvest of 443,590 and is the lowest since the 2004-05 season. 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 446,000 birds annually.

Based on 2018-19 results from the Pacific Flyway wingbee, mallards comprised 54% of Washington's, followed by American wigeon (16%), American green-winged teal (12%), and northern pintail (7%) of total duck harvest, with 23 other species of duck constituting the remaining 11% of harvest (Table 7).

The total Canada goose harvest for 2018-19 was 69,874 during the regular season, with an additional 6,956 taken during the September season, a decrease of 7.8% compared to 2017-18, but similar to the 2016-17 harvest of 70,532. The 2017-18 harvest set a new combined Canada goose harvest record of 83,492 with 75,782 geese taken during the regular season and 7,710 during the September season. A record low harvest of 26,479 occurred in 2004-05. 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 2018-19 large Canada goose harvest (40,297) was 50% above the long-term average.

The harvest of small Canada geese in 2018-19 (25,763) is consistent with the most recent 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. During the 2018-19 season, Region 2 accounted for 26% of the harvest followed by Region 3 (22%) and Region 4 (22%). The proportion of duck harvest was highest in Region 2 (25%), followed by Regions 4 (23%) and 3 (22%). Region 2 accounted for the highest proportion of goose harvest (32%), followed by Region 3 (23%), and Region 1 (21%).

Mandatory Harvest Reporting Results

Restrictive bag limits for most sea ducks were maintained for western Washington in 2018-19. 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 961 scoters, 118 long-tailed ducks, 172 harlequin ducks and 315 goldeneyes (Fig. 13, Table 9). The reported goldeneye harvest included 45% common goldeneye. Primary harvest areas included Island, Mason, Skagit, Clallam, Pierce, and Whatcom counties.

The 2018-19 pre-season count of brant in Padilla/Samish/Fidalgo Bays was below the threshold of 6,000, but above 3,000, allowing the 3-day January brant season in Skagit County. An estimated 241 brant were harvested, a 41% increase of the estimated 170 harvested during the 3-day season in 2017-18. Brant hunting was allowed in Pacific county and harvest of brant was 72, 24% above the 2017-18 estimate of 58 (Fig. 14, Table 10). Additionally, for the second consecutive year, harvest was allowed in Whatcom and Clallam counties resulting in 48 and 90 brant harvested, respectively, after winter counts had consistently placed the 3-year average above the 1,000 brant winter population threshold required to consider opening a county to potential harvest, per WDFW Game Management Plan objectives.

The 2018-19 snow goose harvest was estimated at 7,922, increasing 23% from the 2017-18 harvest of 6,426 (corrected for non-compliance). 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. Additionally, continued reports and coordinated survey efforts suggest that growing numbers of snow geese are being documented in the Lower Columbia River near Vancouver, Washington and in the mid-Columbia River stretch between Burbank, Washington, Umatilla and Boardman Oregon.

In the southwest Washington goose season, hunters who passed the identification test in 1996-2018 and did not take a dusky Canada goose in 2017-18 were authorized to hunt in 2018-19. New hunters and those that illegally harvested a dusky in 2017-18 were required to take a new test to obtain an authorization. Hunters were not required to record harvest or report to check stations. A combination of uniformed and undercover officers documented hunter compliance through individual field checks throughout the regular and late seasons. Of 651 geese classified during bag checks (Table 12), 16 dusky Canada geese were recorded. Figure 16 shows number and species of geese brought to check stations 1969-2015.

Hunter Numbers and Success

The Washington small game hunter survey was used to estimate the number of waterfowl hunters in the state. During the 2018-19 season, an estimated 27,128 hunters participated in the Washington waterfowl season, down about 3% from 2017-18 (Fig. 17). Following a steep decline in 2002, there has been a stable to slightly decreasing number for the last fifteen 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 previous lowest on record.

The estimated average number of ducks harvested per hunter in 2018-19 was 14, the lowest since the 2001-02 season. Despite depressed hunter numbers, 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 but may be struggling to retain hunters that may hunt only a handful of days each season. WDFW continues to evaluate ways of better understanding this discrepancy.

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 more attributable to a lack of recruitment or retention of new waterfowl hunters and changes in social views on hunting.

The quality of waterfowl hunting opportunities in Washington is fair to good and largely driven by winter weather patterns and water availability on the landscape, but certainly the diversity of waterfowl hunting styles (e.g., dabbling ducks, diving ducks, sea ducks, geese and brant) present challenges in accessibility and educating traditional hunting style traditions (e.g., sea ducks and brant). 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 unique and enjoyable hunting recreation for the state’s waterfowl 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 2018-19 there were 6 regulated access areas (RAA) on WDFW lands, including Winchester Ponds, Frenchman Ponds, and North Potholes in Region 2, and Bailie Youth Ranch, Mesa Lake, and Windmill Ranch in Region 3. WDFW also continued the private land access program, referred to as the Waterfowl Habitat and Access Program 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. However, there is continued recognition that habitat enhancements are key to achieving improved hunting experiences, and will be emphasized, over “quality”, in the upcoming seasons.

RECOMMENDATIONS

- Attempt to minimize harvest regulation adjustments over the next three-year period and continue to evaluate harvest opportunities and access limitations.
- Provide summary of mallard and Canada goose band returns in future reports.

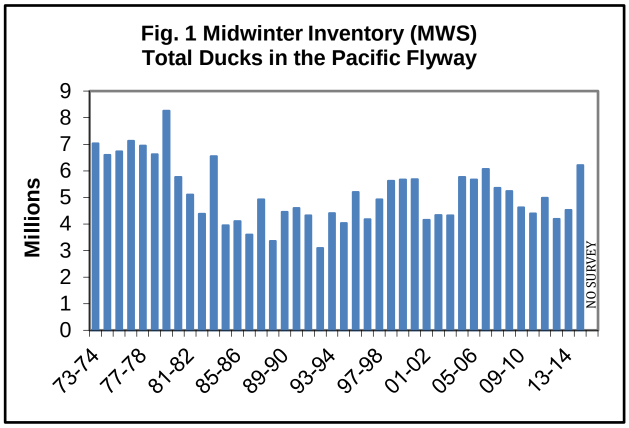


Fig. 1 Midwinter Inventory (MWS)
Total Ducks in the Pacific Flyway
Millions
0
1
2
3
4
5
6
7
8
9
NO SURVEY
73-74
77-78
81-82
85-86
89-90
93-94
97-98
01-02
05-06
09-10
13-14

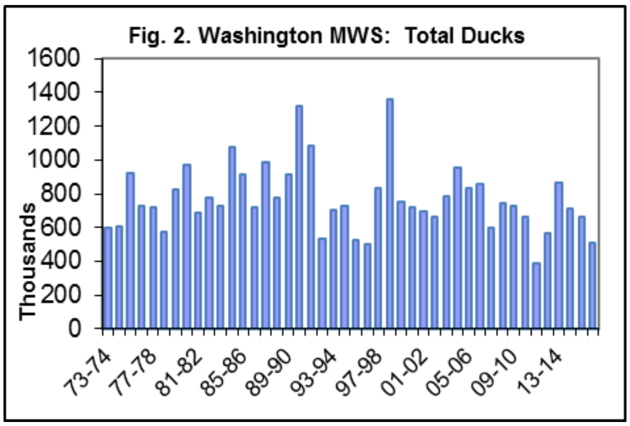


Fig. 2. Washington MWS: Total Ducks
Thousands
0
200
400
600
800
1000
1200
1400
1600
73-74
77-78
81-82
85-86
89-90
93-94
97-98
01-02
05-06
09-10
13-14

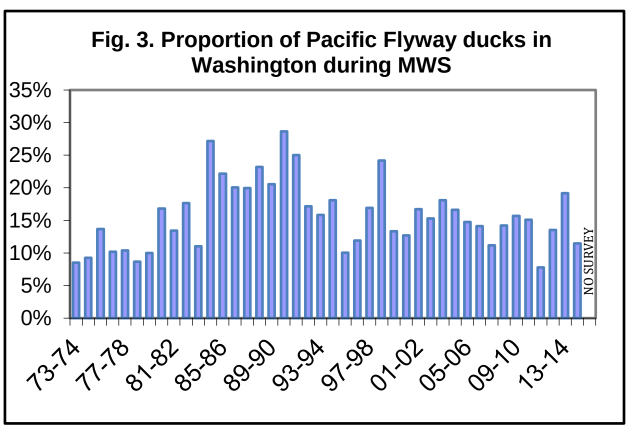


Fig. 3. Proportion of Pacific Flyway ducks in Washington during MWS
0%
5%
10%
15%
20%
25%
30%
35%
NO SURVEY
73-74
77-78
81-82
85-86
89-90
93-94
97-98
01-02
05-06
09-10
13-14

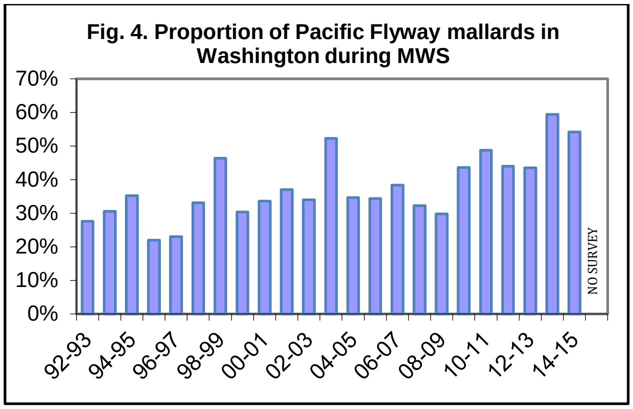


Fig. 4. Proportion of Pacific Flyway mallards in Washington during MWS
70%
60%
50%
40%
30%
20%
10%
0%
NO SURVEY
92-93
94-95
96-97
98-99
00-01
02-03
04-05
06-07
08-09
10-11
12-13
14-15

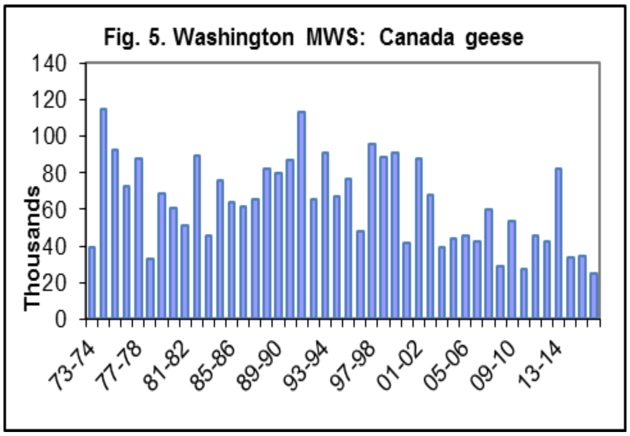


Fig. 5. Washington MWS: Canada geese
Thousands
140
120
100
80
60
40
20
0
73-74
77-78
81-82
85-86
89-90
93-94
97-98
01-02
05-06
09-10
13-14

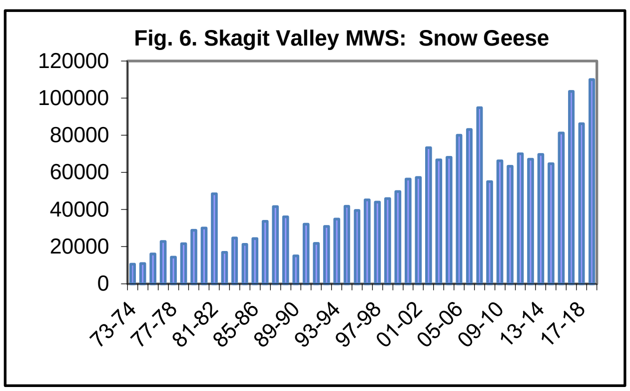


Fig. 6. Skagit Valley MWS: Snow Geese
120000
100000
80000
60000
40000
20000
0
73-74
77-78
81-82
85-86
89-90
93-94
97-98
01-02
05-06
09-10
13-14
17-18

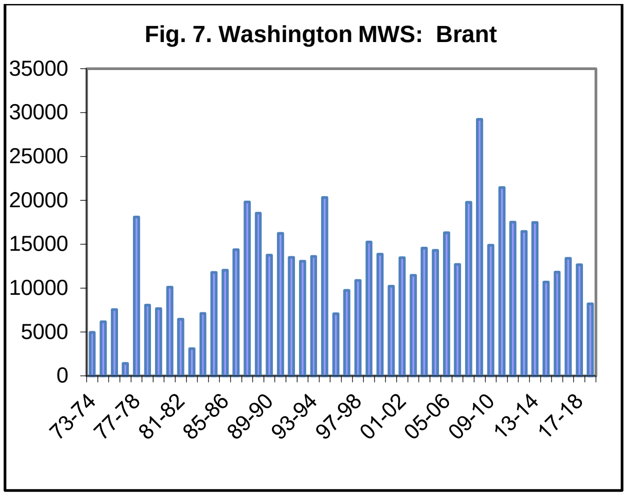


Fig. 7. Washington MWS: Brant
35000
30000
25000
20000
15000
10000
5000
0
73-74
77-78
81-82
85-86
89-90
93-94
97-98
01-02
05-06
09-10
13-14
17-18

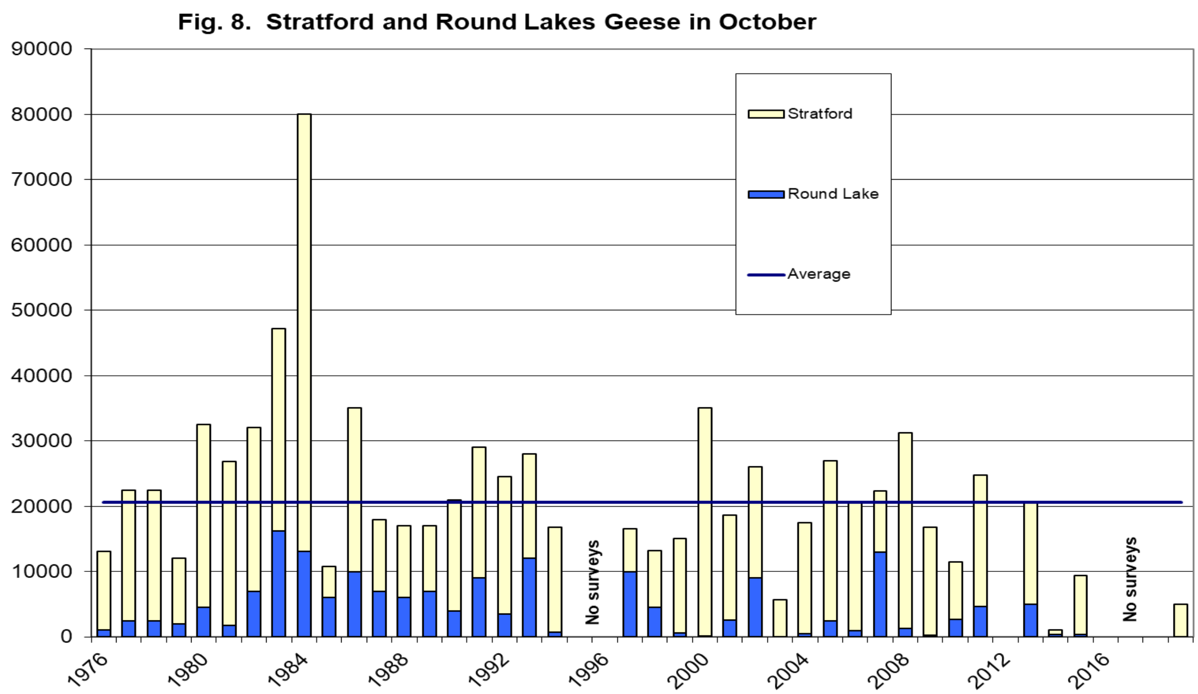


Fig. 8. Stratford and Round Lakes Geese in October
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
Stratford
Round Lake
Average
No surveys
No surveys
1976
1980
1984
1988
1992
1996
2000
2004
2008
2012
2016

Figure 9. Washington Goose Management Areas.

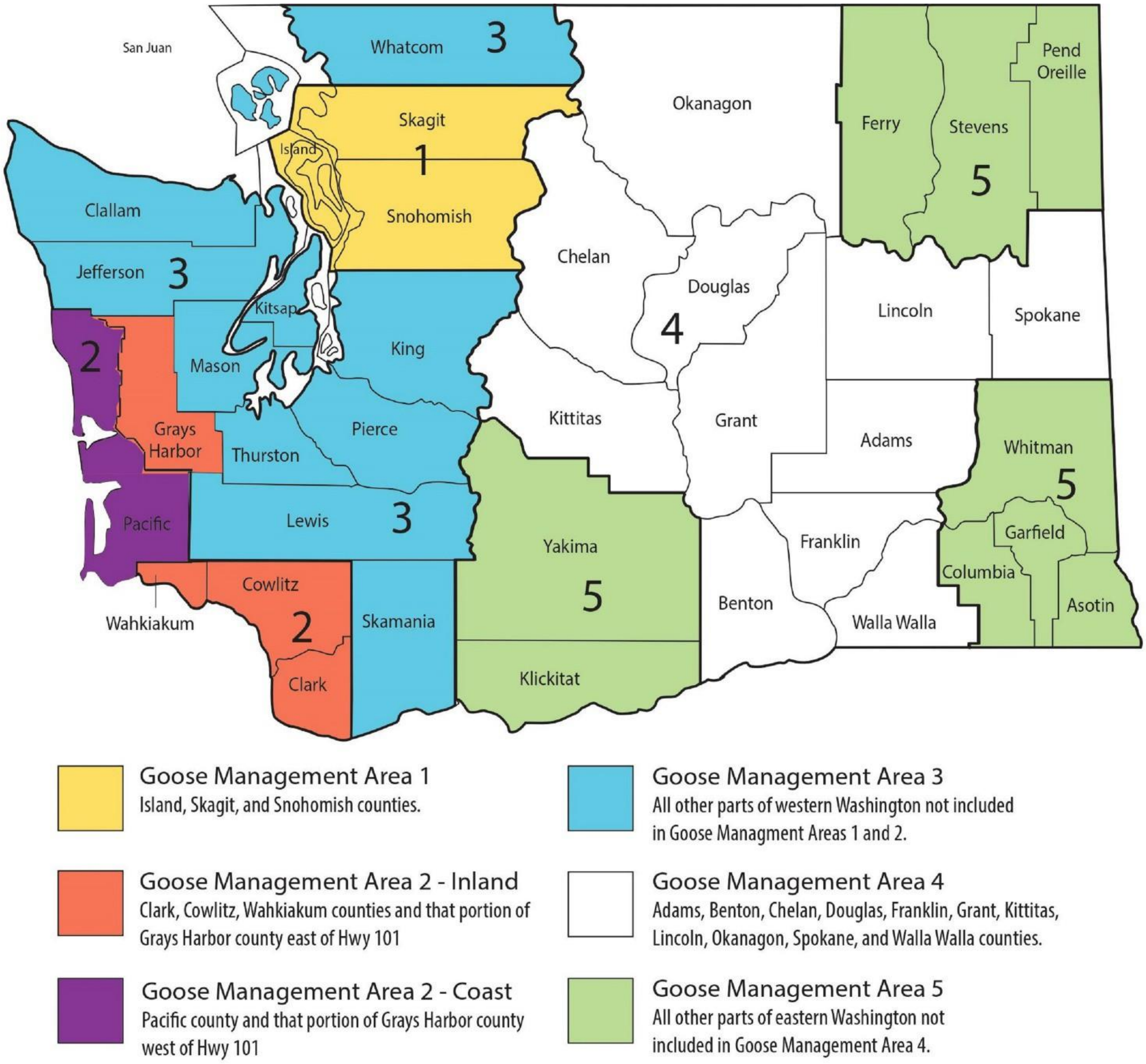


Figure 10. Total harvest of ducks in Washington (1962 - 2018).

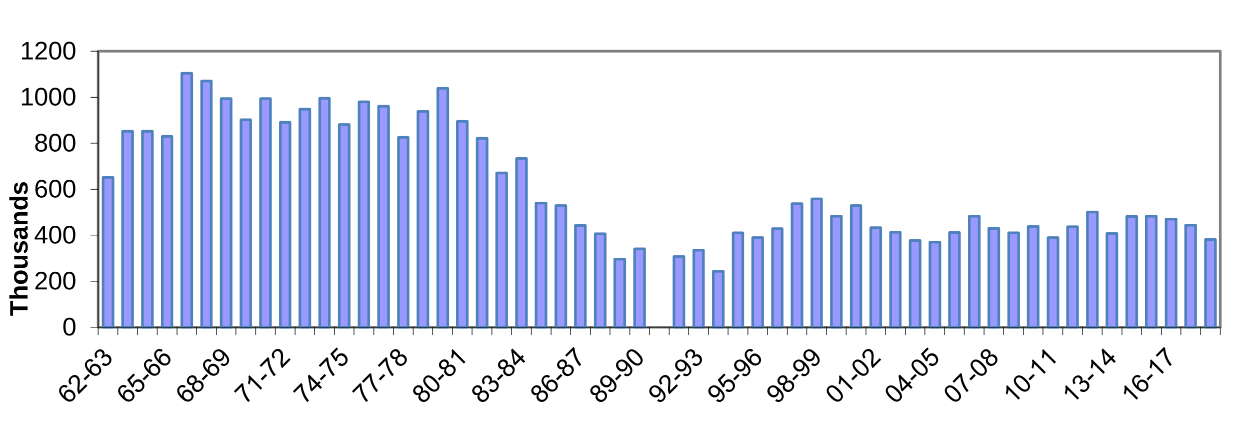
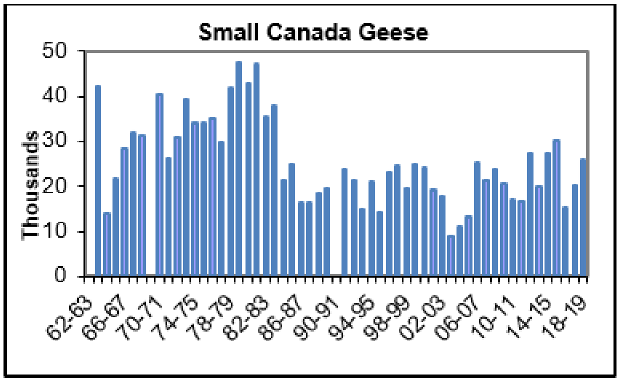


Figure 11. Small and large Canada goose harvested in Washington (1962-2017).



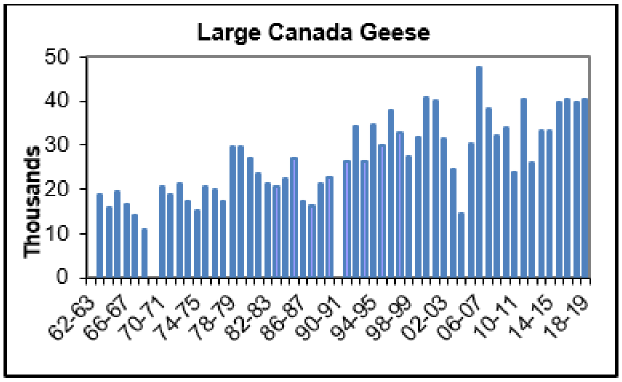


Fig 12. Waterfowl Harvest by Region

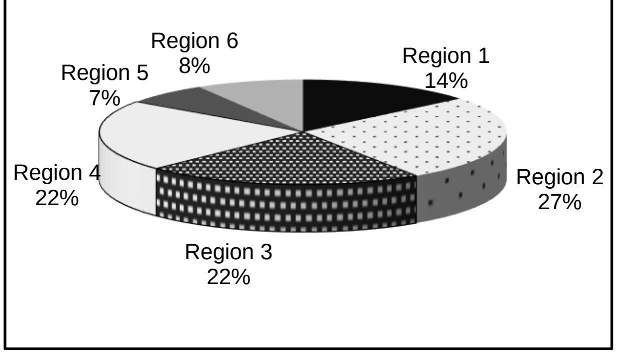
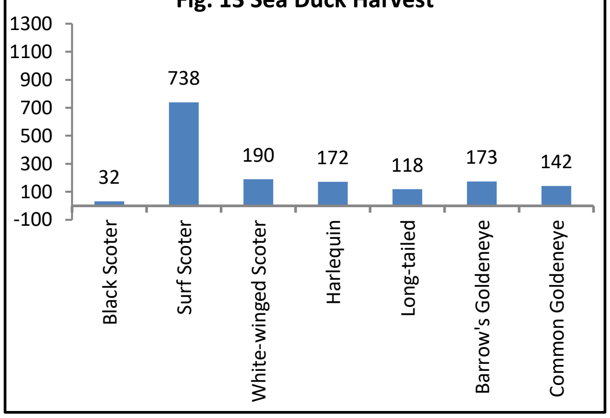
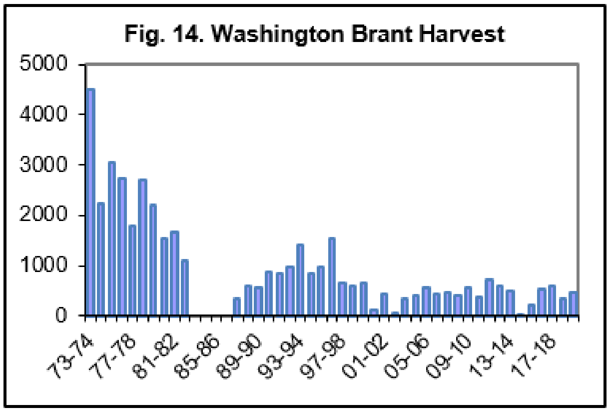


Fig. 13 Sea Duck Harvest





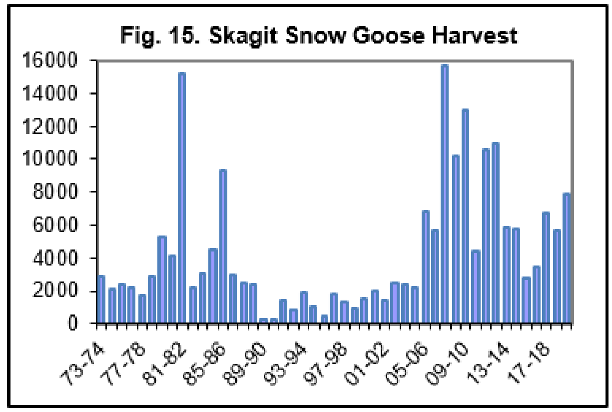


Figure 16. Southwest Washington goose harvest as determined at check stations, Goose Management Areas and 2B, 1970-2015. Check stations were discontinued 2015.

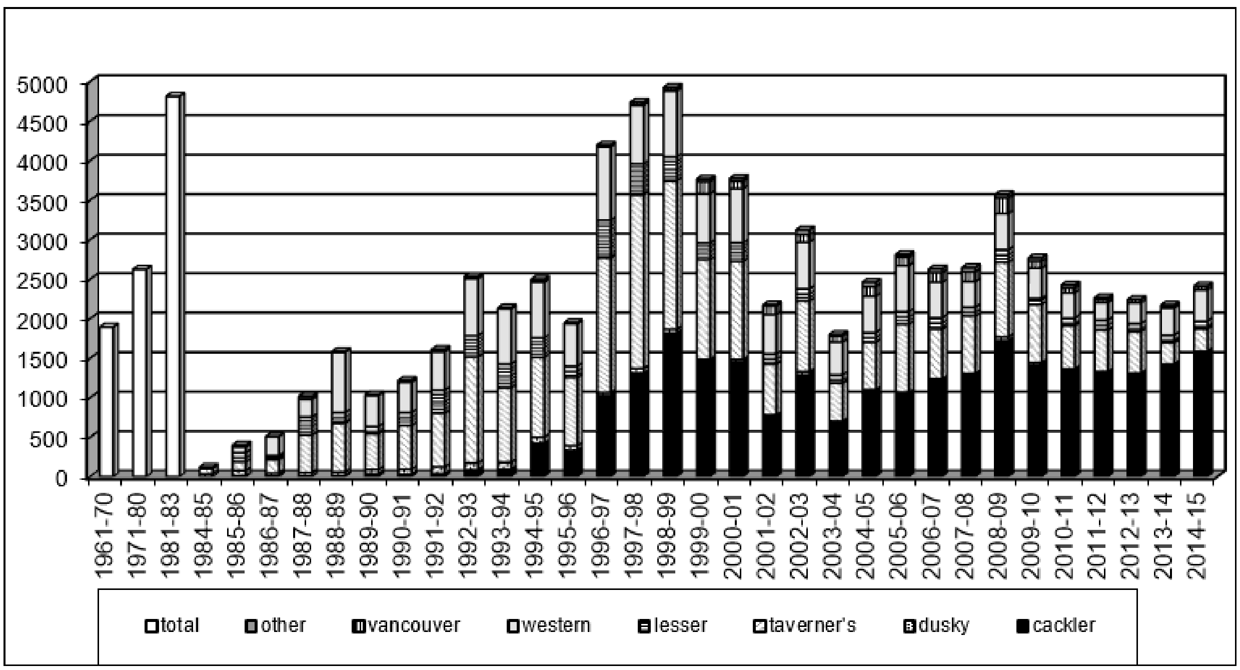


Fig. 17. Washington Waterfowl Hunters

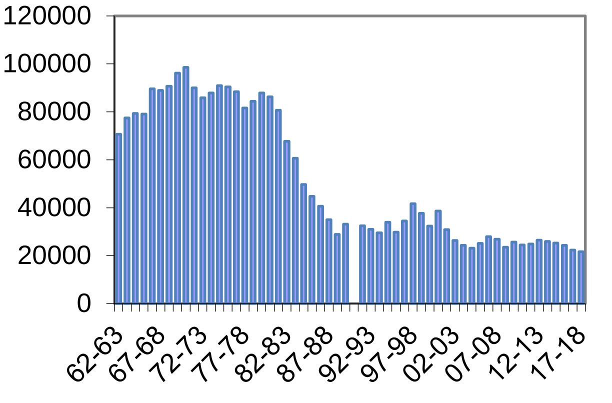


Fig. 18. Duck Hunter Success Rates

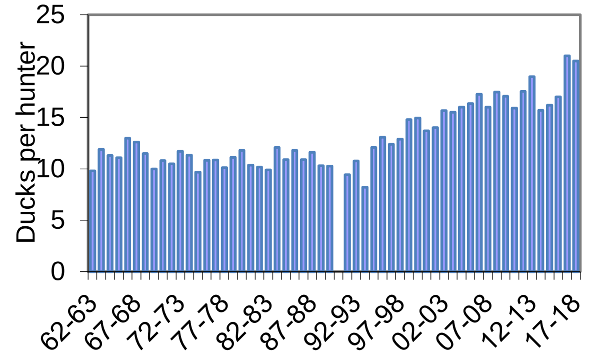


Table 1. Washington Department of Fish and Wildlife Midwinter Waterfowl Survey (MWS) – January 2007 - 2018.

Species	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	18 vs 17	18 vs. 10yr	09-18avg.
Mallard	494,597	313,871	254,655	405,604	349,790	282,601	254,057	529,671	381,428	227,894	194,071	96,885	-50%	-67%	297666
Gadwall	5,314	5,854	5,324	6,877	4,149	3,790	4,236	2,209	2,845	3,148	2,498	861	-66%	-76%	3594
Wigeon	90,734	89,614	207,236	126,059	106,149	101,072	102,264	112,831	123,440	132,633	115,949	84,451	-27%	-30%	121208
Green-winged Teal	30,947	15,506	15,175	11,554	18,795	16,225	8,559	14,196	22,277	36,805	12,728	16,986	33%	-2%	17330
B.W. & Cinn. Teal	272	2	12	20	335	9	3	4	4	19	2	3	50%	-93%	41
Shoveler	8,763	2,210	2,671	2,474	919	5,419	2,793	3,872	2,121	3,110	3,807	2,964	-22%	-2%	3015
Pintail	113,949	45,848	117,235	40,787	71,083	73,635	66,024	71,339	109,825	100,585	73,239	63,035	-14%	-20%	78679
Wood Duck	99	378	309	1,406	501	380	150	9,796	220	149	340	55	-84%	-96%	1331
Redhead	3,645	2,443	4,668	3,550	4,015	2,501	3,226	1,132	761	1,731	1,377	25	-98%	-99%	2299
Canvasback	1,501	3,790	3,239	3,789	3,148	2,157	1,528	462	1,489	3,437	719	641	-11%	-69%	2061
Scaup	29,711	35,052	40,306	43,003	31,118	49,304	52,394	41,984	42,610	67,746	59,098	16,957	-71%	-62%	44452
Ringneck	12,642	16,568	19,740	8,763	5,192	5,415	3,937	5,327	8,552	12,625	19,682	3,180	-84%	-66%	9241
Goldeneye	13,973	15,106	15,976	14,578	14,457	11,599	13,570	10,700	10,507	13,813	8,260	572	-93%	-95%	11403
Bufflehead	17,511	21,230	25,510	21,609	19,451	24,019	19,830	29,131	23,964	22,594	15,261	3,242	-79%	-84%	20461
Ruddy Duck	2,179	3,096	1,508	1,428	1,180	2,026	1,744	2,353	2,626	4,755	1,695	2,373	40%	9%	2169
Eider	-	-	-	-	-	-	-	-	-	-	-	-	0%	0%	0
Scoter	15,307	16,742	12,585	10,445	11,944	13,432	13,677	13,287	14,799	14,320	922	294	-68%	-97%	10571
Long-tailed Duck	804	504	547	439	663	652	722	867	872	690	95	13	-86%	-98%	556
Harlequin	733	902	670	839	692	1,067	918	961	1,019	1,101	78	-	-100%	-100%	735
Merganser	7,443	6,377	6,523	7,894	8,775	8,302	8,262	8,771	8,834	10,239	6,303	1,953	-69%	-74%	7586
Unidentified Ducks	4,731	2,515	9,981	13,440	5,507	-	2,765	9,180	2,846	5,959	885	4,783	440%	-14%	5535
Snow Goose*	75,141	82,583	55,016	66,176	38,976	49,699	56,973	50,354	52,023	71,714	103,617		-100%	-100%	60505
White-fronted Goose	82	42	119	22	113	36	47	24	41	48	35	11	-69%	-78%	50

Table 1. Washington Department of Fish and Wildlife Midwinter Waterfowl Survey (MWS) – January 2007 - 2018. (Continued)

Species	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	18 vs 17	18 vs. 10yr	09-18avg.
Canada Goose	42,759	60,131	28,629	53,259	26,999	45,641	42,686	82,347	33,564	34,445	24,863	22,544	-9%	-43%	39498
Brant	12,712	19,775	29,243	14,895	21,457	17,502	16,454	17,485	10,706	11,811	15,878	12,652	-20%	-25%	16808
Tundra Swan**	3,548	3,570	3,380	3,211	2,544	2,247	1,652	1,171	1,767	3,654	2,108	2,403	14%	0%	2414
Trumpeter Swan**	9,104	7,747	9,852	9,457	9,984	7,603	11,043	11,623	14,225	14,201	18,334	18,404	0%	48%	12473
Unknown Swan**	842	292	1,100	540	221	1,775	2,381	3,609	2,929	1,823	826	1,123	36%	-31%	1633
Total Waterfowl	999,043	771,748	871,209	872,118	758,157	728,108	691,895	1,034,686	876,294	801,049	682,670	356,410	-48%	-54%	767260
Coot	72,265	69,305	101,951	84,543	54,017	48,978	51,996	43,827	69,030	146,899	122,302	5,993			72954
B.C. Snow Geese	8,007	12,276	2,495	7,788	24,285	22,265	10,225	19,633	17,309	11,954					14494

**Comprehensive western Washington swan surveys in 1989, 1991, 1996, 2001, 2006, 2011, 2016. 2018 data includes only western Washington.

Table 2. Puget Sound long-term winter survey estimates for sea ducks.

Species	2017 Estimate	% Change from 2016	Long Term Average	% Change from LTA	3-Year Winter Index	% Above Harvest Closure Threshold	Current Regulation Package
All Scoters	46570	-25.2	62589.9	-25.6	57005.3	26.7	Restrictive - 2
Surf Scoter	36483	-15.3	45148.7	-19.2			
White-winged Scoter	9141	-50.1	16165.9	-43.5			
Black Scoter	946	14.7	1275.3	-25.8			
Common Goldeneye	19822	-2.8	18261.8	8.5			
Barrow's Goldeneye	14104	-2.4	13043.6	8.1			
Bufflehead	55823	-2.6	65625	-14.9			
Harlequin Duck	3460	-33.7	4599	-24.8			
Long-tailed Duck	5745	7.8	5310.7	8.2			
Red-breasted Merganser	18057	36.1	11483.9	57.2			
Common Merganser	4371	-31	4683	-6.7			
Hooded Merganser	1768	4.1	1560.1	13.3			
Total Sea Ducks	**169720**	**-8.9**	**187157**	**-9.3**			

All Washington Salish Sea Basins

Table 3. 2018-19 Limited waterfowl surveys conducted in the Columbia Basin and North Puget Sound; snow goose photo counts, aerial brant surveys, swan age-ratio counts conducted in North Puget Sound.

North Columbia Basin	**Oct.**	**Nov.**	**Dec.**	**Jan.**
Mallards				
Total Ducks				
Total Geese	No	No	No	No
Total Swans	Survey	Survey	Survey	Survey
Total Coots				
SURVEY TOTAL				
South Columbia Basin	**Oct.**	**Nov.**	**Dec.**	**Jan.**
Mallards				
Total Ducks				
Total Geese	No	No	No	No
Total Swans	Survey	Survey	Survey	Survey
Total Coots				
SURVEY TOTAL				
Yakima Basin	**Oct.**	**Nov.**	**Dec.**	**Jan.**
Mallards				
Total Ducks				
Total Geese	No	No	No	No
Total Swans	Survey	Survey	Survey	Survey
Total Coots				
SURVEY TOTAL				
Northern Puget Sound	**Oct.**	**Nov.**	**Dec.**	**Jan.**
Mallards				
Northern pintail				
American wigeon	No	No	No	No
Green-winged teal	Survey	Survey	Survey	Survey
TOTAL DABBLERS				

Snow Goose Counts	**Date**	**Skagit/ Snohomish/ Island Co. Fraser**	**Survey Type**	**% Young**
	12/31/2018	109,993	Aerial – Photo Count	20.6
	3/20/2019	105,432	Aerial – Photo Count	n/a

Brant Aerial Surveys	**Date**	**Skagit Co. Whatcom Co.**	**Survey Type**	
	12/31/2018	5,203	Aerial – Photo Count	
	No Survey		Aerial – Visual	

Swan Age Ratios - North Puget Sound

Species	**Sample size**	**Juveniles**	**% Young**	
Trumpeter Swan	14,833	1,797	12.1%	
Tundra Swan	1,560	133	8.5%	

Table 4. 2018-19 Washington migratory bird season regulations.

Species	Area	Season Dates (inclusive)/Restrictions	Daily Bag Limit	Possession Limit
Duck	Western Washington Youth	Sept. 22 – 23 (Youth Hunting Only[a])	7[b]	14[b]
	Eastern Washington Youth	Sept. 29 – 30 (Youth Hunting Only[a])	7[b]	14[b]
	Statewide	Oct. 13 – 31 & Nov. 3 – Jan. 27, except scaup season closed Oct. 13 – Nov. 2	7[b]	21[b]
Coot	Western Washington Youth	Sept. 22 – 23 (Youth Hunting Only[a])	25	50
	Eastern Washington Youth	Sept. 29 – 30 (Youth Hunting Only[a])	25	50
	Statewide	Oct. 13 – 31 & Nov. 3 – Jan. 27	25	75
Snipe	Statewide	Oct. 13 31 & Oct. Nov. 3 – Jan. 27	8	24
Canada Goose Early Seasons	Goose Mgmt Areas 1 & 3	Sept. 8 – 13	5[c]	15[c]
	Goose Mgmt Area 2, Coast and Inland	Sept. 1 – 9	5[c,d]	15 [c,d]
	Goose Mgmt Areas 4 & 5	Sept. 8 – 9	5[c]	10[c]
Goose (except Brant)	Statewide	Sept. 22 – 23 (Youth Hunting Only[a], Canada & White-fronted goose only	4[c]	8[c]
		Sept. 29 – 30 (Youth Hunting Only[a], Canada & White-fronted goose		
	Goose Mgmt Area 1	Snow, Ross', Blue, White-fronted Goose : Oct. 14 - Jan. 28[d]	4	12
		Canada (except Brant): Oct. 14-26 & Nov. 4 - Jan. 28		
	Goose Mgmt Area 2 – Coast[f]	All areas except Willapa National Wildlife Refuge: Everyday Oct. 13 – 28, Saturday, Sundays, & Wednesdays only Nov. 3 – Dec. 2, Dec.22 – Jan. 20, and Feb. 2 –16. During Feb. 2 – 16, public lands are closed to goose hunting in this area	4[f]	12[f]
		Willapa National Wildlife Refuge; Wednesday, Saturday, & Sunday Only, Oct. 13 – 28, Nov. 3 – Dec. 2, Dec. 22 – Jan. 20.		
	Goose Mgmt Area 2 – Inland[f]	All areas except Ridgefield National Wildlife Refuge: Everyday Oct. 13 – 28, Saturdays, Sundays, & Wednesdays only Nov. 24 – Jan. 13 and Feb. 9 – Mar. 9. During Feb. 9 – Mar. 9, public lands are closed to goose hunting in this area.	4[f]	12[f]
		Ridgefield National Wildlife Refuge:Tuesdays, Thursdays, & Saturdays only Oct. 13 – 27 and Nov. 24 – Jan.12[e]		
	Goose Mgmt Area 3	Oct. 13-25 & Nov. 3 - Jan. 27	4	12
	Goose Mgmt Area 4	Saturdays, Sundays, & Wednesdays only: Oct. 13 – Jan. 20; Nov. 12, 22, 23 ; Dec. 24, 25, 27, 28, 31; Jan. 1 ; & everyday Jan. 21-27	4	12
	Goose Mgmt Area 5	Oct. 13-29 & Nov. 3 - Jan. 27	4	12
Brant	Skagit County	Jan. 12, 13, 16, 19, 20, 23, 26, and 27 **Note:** If Skagit County pre-season brant population is 3,000 – 6,000 (determined by midwinter waterfowl survey), this season will be open only on the following dates: Jan. 12, 16, and 19. If the Skagit County pre-season brant population is below 3,000 (as determined by the midwinter waterfowl survey), this season will be canceled.	2	6
	Clallam & Whatcom	Jan. 12, 16, and 19	2	6
	Pacific County	Jan. 12, 13, 15, 17, 19, 20, 22, 24, 26, and 27		

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, 1 pintail, 3 scaup , 2 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, 2 pintail, 6 scaup, 4 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, 3 pintail, 6 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. 30 minutes after the start of the official waterfowl hunting hours to 30 minutes before the end of the official waterfowl hunting hours.
f. Daily bag limit: 4 geese, except for dusky Canada Geese. Possession limit: 12 geese, except for dusky Canada geese. Dusky Canada goose season closed. 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	" "	1	6.00	15.00	15.00	Tungsten-polymer added
99-00	106[5]	106[5]	7	7	" "	1	6.00	15.00	30.00[4]	Tungsten-matrix added
00-01	105[6]	105[6]	7	7	" "	1	6.00	15.00	30.00	" "
01-02	105[6]	105[6]	7	7	" "	1	6.00	15.00	30.00	Tungsten-nickel-iron added
02-03	105[6]	105[6]	7	7	" "	1[7]	10.00	15.00	30.00	TINT[8] added
03-04	105[6]	105[6]	7	7	" "	1[9]	10.00	15.00	30.00	" "
04-05	105[6]	105[6]	7	7	" "	1[10]	10.00	15.00	30.00	Tungsten-bronze & tungsten-Tin-bismuth added
05-06	105[6]	105[6]	7	7	" "	1	10.00	15.00	30.00	" "
06-07	105[6]	105[6]	7	7	" "	1	10.00	15.00	30.00	Tungsten-iron-copper-nickel, Tungsten-tin-iron added
07-08	105[6]	105[6]	7	7	" "	1	10.00	15.00	30.00	Tungsten-tin-iron-nickel added
08-09	105[6]	105[6]	7	7	" "	1	10.00	15.00	30.00	
09-10	105[6]	105[6]	7	7	" "	2	11.00	15.00	36.00	
10-11	105[6]	105[6]	7	7	" "	2	11.00	15.00	36.00	
11-12	105[6]	105[6]	7	7	" "	2	15.00	15.00	38.00	
12-13	105[6]	105[6]	7	7	" "	2	17.00	15.00	40.50	
13-14	105[6,a]	105[6,a]	7	7	" "	2	17.00	15.00	40.50	
14-15	105[6,b]	105[6,b]	7	7	" "	2	17.00	15.00	40.50	
15-16	105[6,c]	105[6,c]	7	7	" "	2	17.00	25.00	40.50	Copper-clad iron added
16-18	105[6,c]	105[6,c]	7	7	" "	1	17.00	25.00	40.50	
18-19	105[6,d]	105[6,d]	7	7	7 (2 ♀)	2	17.00	25.00	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) [c]scaup (lesser and greater) season limited to 86 days (Nov. 7-Jan. 31) [d]scaup (lesser and greater) season limited to 86 days (Nov. 3-Jan. 27)

Table 6. History of southwest Washington Canada goose season regulations.

Year	Season	ID Class	Quota	Scheduled Dates (# days)	Closure (# Days Hunted / Scheduled)
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)

Table 6. History of southwest Washington Canada goose season regulations. (Continued)

Year	Season	ID Class	Quota	Scheduled Dates (# days)	Closure (# Days Hunted / Scheduled)
2015-2016	Regular	New	N/A**	2A: Nov. 14 – Dec 6; Dec. 16- Jan. 31 (32, RF 30) 2B: Oct. 17 – 25; Nov. 14 – Jan. 10 (32)	2A: No (32/32, RF 30/30) 2B: No (32/32)
	Late	New	N/A**	2A and 2B: Feb. 10 – Mar. 9*** (13/13)	2A/2B: No (13/13)
2016-2017	Regular	New	N/A**	2: Oct. 15 – 23; Nov. 26 – Jan. 22 (31, RF 32)	2: No (31/31, RF 32/32)
	Late	New	N/A**	2: Feb. 11 – Mar. 8*** (12/12)	2: No (12/12)
2017-2018	Regular	New	N/A**	2: Oct. 14 – 29; Nov. 26 – Jan. 22 (31, RF 29)	2: No (39/39, RF 29/29)
	Late	New	N/A**	2: Feb. 10 – Mar. 10*** (13/0)	2: No (13/13)
2018-2019	Regular – Coast	New	N/A**	2C: Oct. 13 – 28; Nov. 3 – Dec. 2, Dec. 22 – Jan. 20 (44, WB 35)	2: No (38/38, WB 35/35)
	Late – Coast	New	N/A**	2C: Feb. 2 – Feb. 16*** (7)	2: No (7/7)
	Regular – Inland	New	N/A**	2I: Oct. 13 – 28; Nov. 24 – Jan. 13, (38, RF 30)	2: No (38/38, RF 30/30)
	Late – Inland	New	N/A**	2I: Feb. 9 – Mar. 9*** (13)	2: No (13/13)

* 2A=Clark, Cowlitz, Wahkiakum; 2B=Grays Harbor, Pacific; 2C=Pacific, Grays Harbor west of highway 101; 2I=Clark, Cowlitz, Wahkiakum, Grays Harbor east of highway 101. 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; WB=Willapa Bay National Wildlife Refuge; **Dusky harvest closed; ***public lands closed.

Table 7. Waterfowl harvest by species in Washington (2018-19)[1].

Species	Harvested	Composition (%)
Mallard	206,372	54
Northern pintail	26,319	7
American wigeon	61,334	16
Green-winged teal	44,499	12
Total ducks	380,726	
Large Canada (+ Sept Season[2])	40,297 (6,956)	61
Small Canada	25,763	31
Total geese	**76,830**	
Total waterfowl	**457,556**	

[1]The number of each species harvested is estimated from the proportions derived from the Pacific Flyway Wingbee parts collection survey. The total number of ducks and geese harvested is estimated from the Small Game Harvest Questionnaire which differentiates September Canada Goose season from the Regular Canada Goose season.
[2]The September season is not considered in the composition of Large to Small Canada goose in the total regular season harvest.

Table 8. Waterfowl harvest by region (2018-19).

Region	Ducks Harvested	% of State Total Ducks Harvested	Geese Harvested	% of State Total Geese Harvested
Region 1	49,297	13%	13,863	21%
Region 2	94,747	25%	21,361	32%
Region 3	84,493	22%	15,274	23%
Region 4	88,162	23%	10,700	16%
Region 5	27,308	7%	3,058	5%
Region 6	36,719	10%	1,804	3%

Table 9. Estimated number of sea ducks harvested in 2018-19[1].

Species	Harvest
Scoters	961
Black Scoter	32
Surf Scoter	738
White-winged Scoter	190
Harlequin	172
Long-tailed	118
Barrow’s Goldeneye	173
Common Goldeneye	142
TOTAL	**1,566**

[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	HUNTER SUCCESS	HUNTER DAYS	SEASON DAYS BY COUNTY	SKAGIT COUNTY HARVEST	WHATCOM COUNTY HARVEST	CLALLAM COUNTY HARVEST	PACIFIC COUNTY HARVEST	TOTAL HARVEST
1990	DEC	490	338	763	11	808	0	0	73	881
1991	DEC	654	330	647	11	790	3	0	52	845
1992	DEC	747	319	709	11	950	9	0	18	977
1993	DEC	1194	496	765	11	1347	7	0	53	1407
1994	DEC	1069	287	484	9	825	0	0	23	848
1995	DEC	1207	343	552	11	918	0	0	44	962
1996	DEC	1445	254	549	11	1493	0	0	41	1534
1997	JAN	1331	197	326	5	597	0	0	59	656
1998	JAN	1348	243	350	5	570	0	0	18	588
1999	JAN	1336	218	386	9	581	0	0	86	667
2000	JAN	1295	39	59	5*	0	0	0	108	108
2001	NOV				5	56	0	0	20	76
2001	JAN				5	347	0	0	17	364
2001	ALL	1436	187	277	10	403	0	0	37	440
2002	NOV				5	18	0	0	9	27
2002	JAN				5*	0	0	0	33	33
2002	ALL	1387	27	277	10	18	0	0	42	60
2003	NOV				5	22	0	0	13	35
2003	JAN				5	235	0	0	64	299
2003	ALL	1187	152	200	10	257	0	0	77	334
2004	NOV				5	36	0	0	11	47
2004	JAN				5	308	0	0	34	342
2004	ALL	1612	126	209	10	344	0	0	45	389
2005	JAN	1707	220	336	5	504	0	0	53	557
2006	JAN	1793	199	272	7	367	0	0	74	441
2007	JAN	1795	166	243	7	341	0	0	112	453
2008	JAN	2116	191	262	7S/10P	328	0	0	81	409
2009	JAN	1681	232	510	8S/10P	545	0	0	31	576
2010	JAN	1030	200	387	8S/10P	253	0	0	125	378
2011	JAN	1232	214	502	8S/10P	638	0	0	80	718
2012	JAN	1362	254	604	8S/10P	541	0	0	63	604
2013	JAN	1364	192	651	8S/10P	479	0	0	26	505
2014	JAN	1352	14	76	10P	0	0	0	40	40
2015	JAN	1366	193	236	3S/10P	165	0	0	34	199
2016	JAN	1358		548	8S/10P	538	0	0	46	584
2017	JAN	1450	130	388	3S/3W/ 3C/10P	170	28	90	58	346
2018	JAN				3S/3W/ 3C/10P	241	48	90	72	451

[1]Figures based on mandatory report returns, corrected for non-response bias, days hunted estimate from 1990-08 include successful hunters only.

Table 11. Snow goose harvest report summary.

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	6859
2013	2884	861	4013	126	4016	1579	5721
2014	3010	1110	4499	6	2069	683	2758
2015	3005	1099	4704	6	2373	1067	3446
2016	3240		6680				6742
2017	3494		6705				6426[a]
2018	na	na	na	12	4867	2621	7922

*Days hunted 1993-08 include successful hunters only **harvest estimate does not include wounding loss

[a] Corrected for non-compliant reports

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
2015-16[a]	Regular Season[b]	0	397	14	13	75	14	67	37	604	5	1	610
	Late Season[b]	0	154	5	5	29	6	26	15	235	2	1	238
	Season total[c]	0	551	19	18	104	20	93	52	839	7	2	844
2016-17[a]	Regular Season[b]	7	71	4	4	36	0	40	0	152	0	0	152
	Late Season[b]	10	93	5	4	35	0	51	0	199	0	0	199
	Season total[c]	17	164	9	8	61	0	91	0	351	0	0	351
2017-18[a]	Regular Season[b]	2	122	4	5	29	1	27	1	188	0	0	188
	Late Season[b]	2	113	4	5	27	1	25	1	175	0	0	175
	Season total[c]	3	234	7	9	56	1	51	1	362	0	0	362
2018-19[a]	**Season total[b,c,d]**	**6**	**407**	**16**	**37**	**86**	**0**	**60**	**5**	**617**	**17**	**17**	**651**

Note: Mandatory check stations initiated in 1984-85 season, prior estimates from USFWS harvest survey. [a]Check stations discontinued in 2015. [b]Numbers derived from percentage of subspecies identified during physical bag checks and extrapolated to regular and late season.

[c]Total includes only measured birds from bag checks.

[d]No estimate derived for early and late season

Wild Turkey

Wild Turkey Status and Trend Report

STATEWIDE

SARAH GARRISON, Statewide Small Game, Furbearer, and Resident Game Bird Specialist

Management Guidelines and Objectives

Wild turkeys were first successfully introduced in Washington in 1960. Population augmentation in the 1980s and 1990s expanded their distribution and increased hunting and wildlife viewing opportunities (WDFW 2005).

In January 2006, the Department adopted a statewide Turkey Management Plan (WDFW 2005) as a supplement to the Game Management Plan in response to increasing populations and issues related to turkey management. Population management strategies from this plan were included and updated in the 2015-2021 Game Management Plan (WDFW 2014).

Hunting Seasons and Recreational Harvest

Hunter effort and hunter harvest of wild turkeys are estimated based on the analysis of mandatory hunter reports. Hunters owe reports on all turkey tags, including tags they did not use. Successful hunters are required to submit the date, location, and sex of harvested birds. This mandatory reporting system has allowed for better estimates of harvest and hunter participation than estimates made prior to the reporting requirement.

Within Washington State, Game Management Units (GMUs) have been grouped to define seven turkey Population Management Units (PMUs, Table 1, Figure 1). Changes in harvest, as an indicator of population trend, have been tracked at the PMU level. Improvements were made to the turkey harvest data analysis routine in 2011 and 2016, which could account for some variations in estimates, particularly when comparing data across years.

Table 1: Game Management Units (GMUs) included in each Population Management Unit (PMU).

PMU	PMU Name	GMUs Included
10	Northeast	101-136
15	Southeast	139-186
20	North Central	All 200 GMUs
30	South Central	All 300 GMUs EXCEPT GMU 382 & 388
35	Klickitat	GMUs 382, 388, 568-578
40	Northwest	All 400 GMUs PLUS GMUs 601-627
50	Southwest	All 500 GMUs EXCEPT 568-578 PLUS GMUs 633-699

The first official hunting season for wild turkey opened in 1965. The first spring hunts occurred in 1970. In 2008, the statewide spring general season was set for April 15 to May 31 which remains in place today. The spring season is for male turkeys and turkeys with visible beards only. Fall opportunities have varied and generally expanded over the years. In 2018, the early and late fall general seasons in GMUs 101-154 and 162-182 were combined and expanded into a single fall general season running September 1 to December 31. Also, in that year the permit hunt in Klickitat County changed to a fall general season opportunity. The fall seasons allow harvest of either sex.

Two permit hunts are available in the fall. These occur in Okanogan County (Methow, GMUs 218-231 and 242) and Kittitas County (Teanaway, GMU 335). Fall permit hunts allow harvest of either sex.

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. Fall seasons have been expanded in certain areas to increase hunting pressure in response to increased complaints regarding turkey damage and human-wildlife conflict.

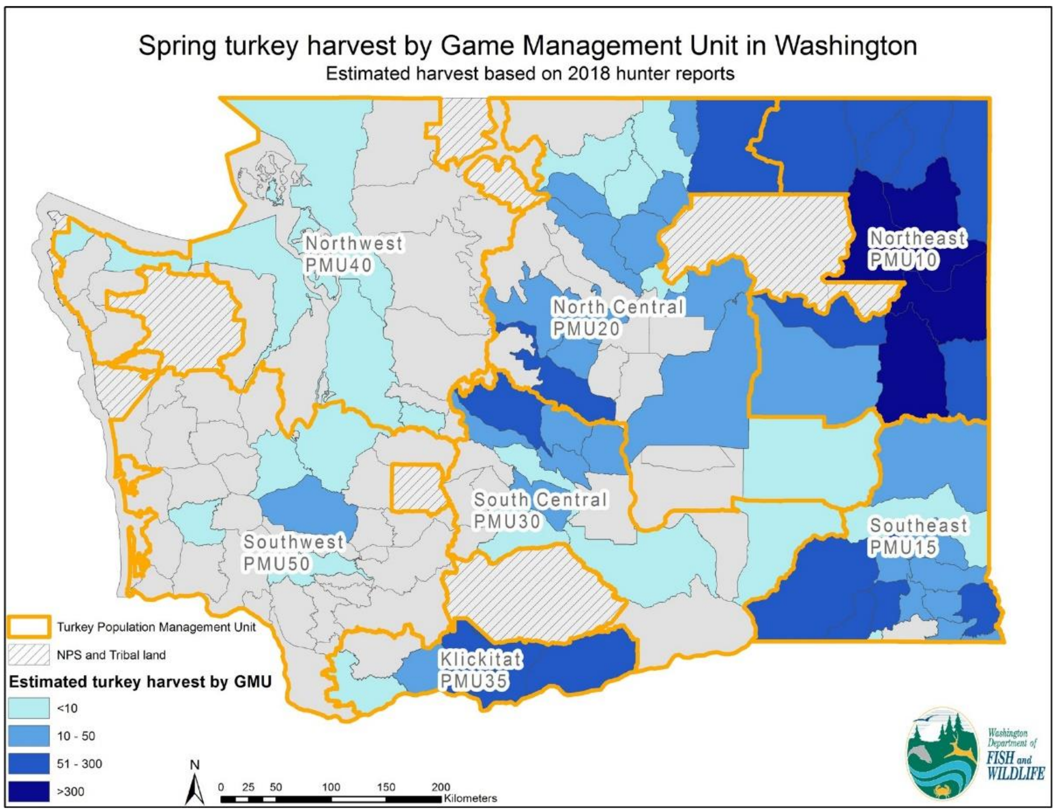


Figure 1: Estimated spring turkey harvest in each Game Management Unit based on 2018 hunter reports.

Spring turkey harvest increased slightly in 2018 while hunter participation decreased slightly, resulting in a 3% increase in hunter success compared to the 2017 spring season. An estimated 10,707 (95% CI=10,160–11,259) individuals hunted turkeys during the 2018 spring season, taking an estimated 5,026 (95% CI=4,646-5,438) birds (Figure 2). An estimated 4,070 (95% CI=3,837-4,313) hunters pursued turkeys during the 2018 fall general seasons with an estimated harvest of 2,296 (95% CI=2,139-2,457) birds. This represents a hunter success rate of 56% (95% CI=48%-58%) in the fall season compared to 47% (95% CI=41%-51%) in the spring season. Permit hunters reported an additional 7 birds taken during fall permit hunts.

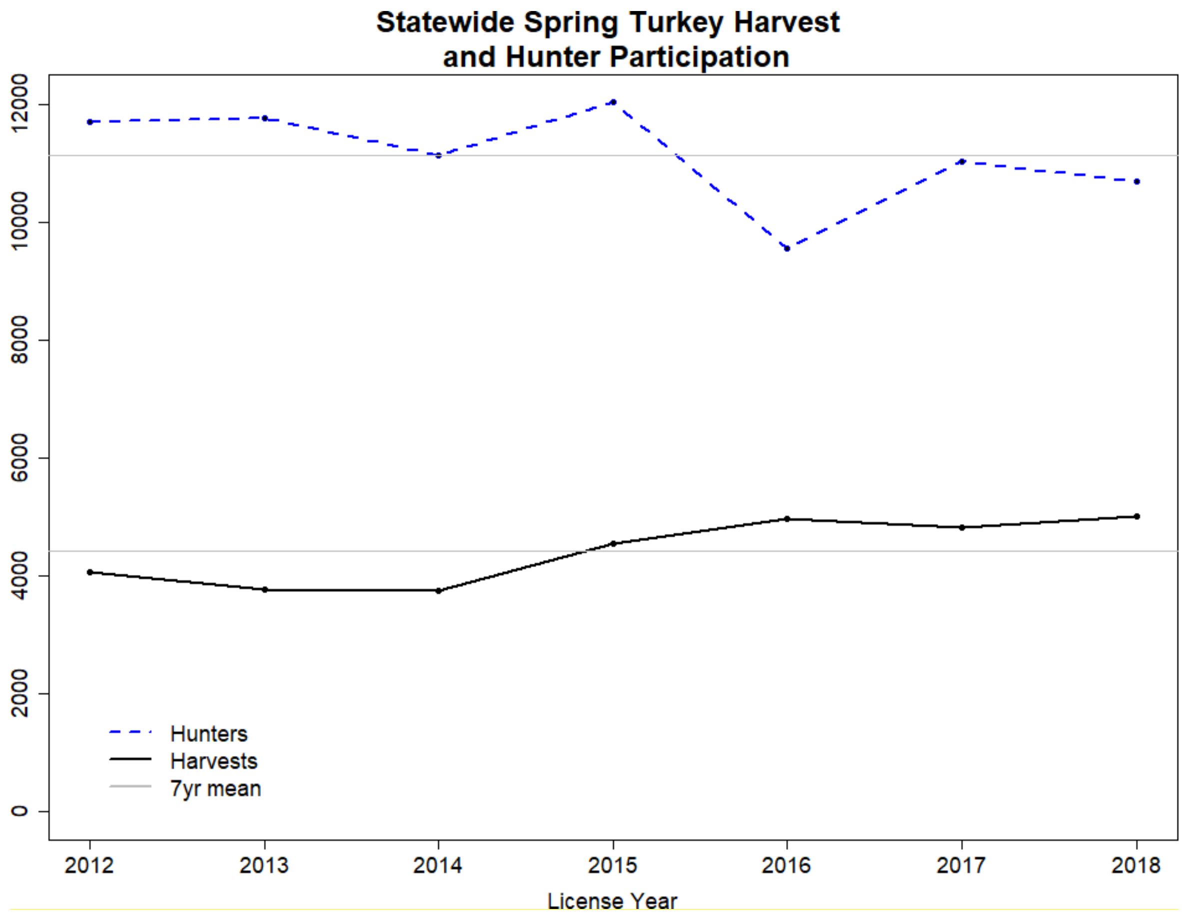


Figure 2: Estimated statewide spring turkey harvest and hunter participation in **2012-2018 with 7-year means.**

Recently, depredation on agricultural land caused by turkeys and conflicts with humans has increased in parts of eastern Washington. Liberal fall general seasons are in place here to help address these issues. Spring harvest estimates in the northeast (PMU 10) stabilized in 2017 and 2018 after the growth of 2015 and 2016. The spring harvest estimate in 2018 was 17% above the 7-year mean in PMU 10. Spring harvest in the southeast (PMU 15) was 3% above the 7-year mean in 2018.

Local hunters have reported concern over decreasing populations in central Washington. Spring harvest estimates in 2018 were 31% and 3% above the 7-year means in PMUs 20 and 30, respectively. Fall hunting opportunities in these areas will continue to be available on a limited permit-only basis.

Spring turkey harvest in PMU 35 has been steady over the past seven years. The spring 2018 harvest estimate was less than 1% below the 7-year mean. The population is believed to be stable and provides the majority of the hunting opportunity in southwest Washington.

Determining population trends for wild turkey in western Washington is limited by lack of data. Wild turkeys are likely reproducing at low levels but maintaining a viable population in PMU 50. Low harvest in this area may be due in part to more restrictive access policies put in place by private landowners.

Table 2: Estimated spring turkey harvest in each turkey Population Management Unit (PMU) 2012-2018.

PMU	2012	2013	2014	2015	2016	2017	2018
P10	2,512	2,400	2,461	3,097	3,421	3,331	3453
P15	642	533	500	531	590	499	563
P20	203	188	181	260	270	331	326
P30	162	143	137	157	208	175	172
P35	514	474	436	475	461	417	456
P40	5	5	1	3	2	5	23
P50	30	25	25	38	28	56	25

Population Surveys

Harvest and hunter effort are used as an index to population trends. District 7 also utilizes winter counts to track turkey numbers in Chelan County. Counts are taken at sites along seven routes in PMU 20 using three replicate surveys to obtain a minimum count and sex ratio. Surveys have been conducted since 2008, though sites surveyed have varied across years. In the 2017-2018 winter count, 598 turkeys were observed, of which 153 were adult males.

Habitat

Habitat enhancement priorities are identified in the 2015-2021 Game Management Plan (WDFW 2014). 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 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 (NWTF) on efforts to promote and fund habitat enhancement work.

Population Augmentation

There were no new releases of turkeys in any PMU across the state and none are planned in the future. Turkeys are present in most of the areas that would be considered suitable habitat. Concerns related to human-wildlife conflict have precluded introductions in the past. WDFW management plans identify trapping and translocation as a potential response to damage and nuisance complaints, but those actions are not a significant part of turkey management. Few translocation activities have occurred in recent years.

Management Conclusions

Turkey populations across the state appear to be stable to increasing with the largest concentrations in eastern Washington. The statewide spring hunter success rate has increased to a 5-year average of 44%. Management decisions will seek to maintain high hunter success rates in the spring while also addressing human conflict issues.

Turkey damage and complaints are being reported from areas within PMU 10 and PMU 15, especially Spokane County. Additional hunting opportunities have been created in these areas to help address these complaints. WDFW will be reviewing ways to focus hunter effort and other management tools in areas with private lands experiencing damage.

Literature Cited

Washington Department of Fish and Wildlife. 2005. Wild Turkey Management Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, Washington, USA.

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

Pheasant

Pheasant Status and Trend Report

STATEWIDE

SARAH GARRISON, Statewide Small Game, Furbearer, and Resident Game Bird Specialist

Population Guidelines and Objectives

Management objectives for upland birds, including pheasant, are outlined in the Washington Department of Fish and Wildlife's (WDFW) Game Management Plan (WDFW 2014). Goals are to bolster pheasant numbers through habitat enhancement to ensure healthy, productive populations for recreation. Additional strategies are 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. Washington-specific strategies are also outlined in the meeting summary from the 2003 Pheasant Workshop (WDFW 2003).

Hunting Seasons and Recreational Harvest

The pheasant harvest season in 2018 began in September with a 2-day statewide youth season followed by a 5-day season for hunters 65 and older and hunters with disabilities. The general pheasant season then ran 93 days in eastern Washington and 62 days in western Washington, with a 15-day extended season in some areas of western Washington.

Nearly all wild pheasant (i.e., not pen-raised) populations occur in eastern Washington due to unsuitable climate and habitat in western 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. Harvest estimates are based on a survey mailed to a stratified random sample of 25,000 hunters.

Harvest estimates and hunter participation have stabilized in the past five years (Figure 1) despite long term declines. In 2018, hunter participation increased 3% from 2017 and was 4% below the 10 year mean of 14,833 hunters. Harvests increased 4% in 2018 and were 6% below the 10-year mean of 45,872 birds. Over the past ten years, eastern Washington pheasant hunters spent an average of 5-days afield and averaged 3-birds per hunter. Though hunter participation has decreased in the long term, the average number of harvests per day has remained stable through the past decade. While long-term pheasant population declines are apparent, it is not fully understood whether limitations on hunting access, economic changes, or other factors might be playing a role in declining participation.

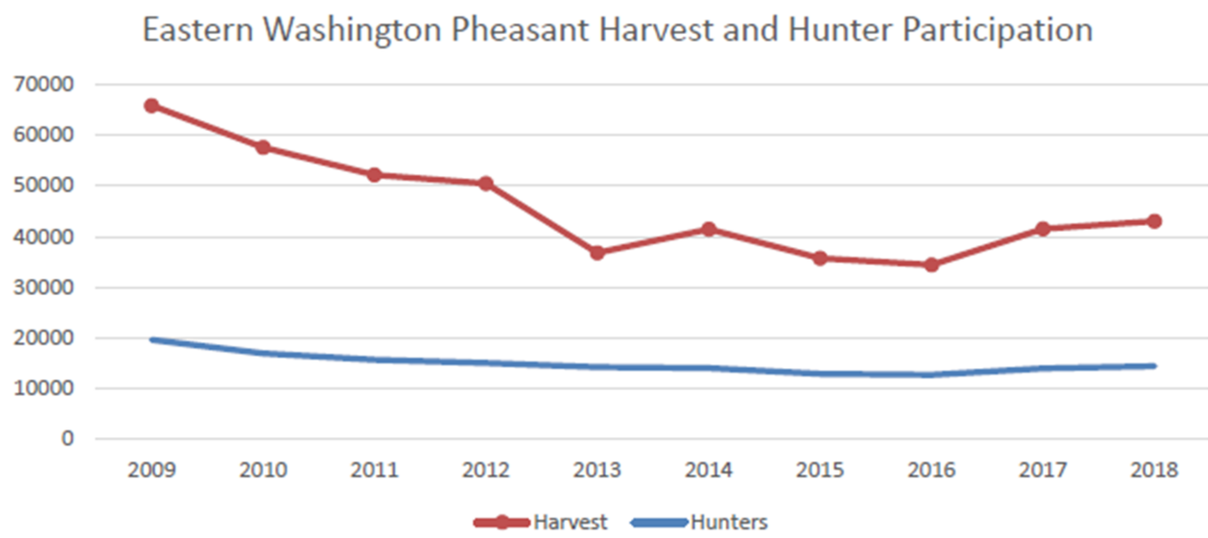


Figure 1: Estimated annual pheasant harvest (pen-raised and wild) and hunter participation in eastern Washington 2009 - 2018.

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).

Since 1997, rooster pheasants have been released in the fall as part of the state-funded Eastern Washington Pheasant Enhancement Program (EWPEP). Harvest estimates have included both released and wild birds; therefore, the harvest of wild pheasants is lower than depicted in Figure 1.

In 2009, the EWPEP was audited at the request of the Legislature. The findings confirmed that WDFW was fulfilling its legislative mandate to release pheasants. Auditors concluded that pheasant populations continued to decline primarily due to loss of habitat and that 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% of EWPEP funding for purchasing domestically reared pheasants for wild release in order to devote more funding to habitat enhancement projects on public and private lands. In 2018, WDFW released 10,002 pheasants in eastern Washington and are planning to release a similar number in the fall of 2019. Funding that is allocated to habitat enhancements will help address objectives identified in the 2015-2021 Game Management Plan (WDFW 2014) to increase the amount of quality pheasant habitat in the pheasant focus area.

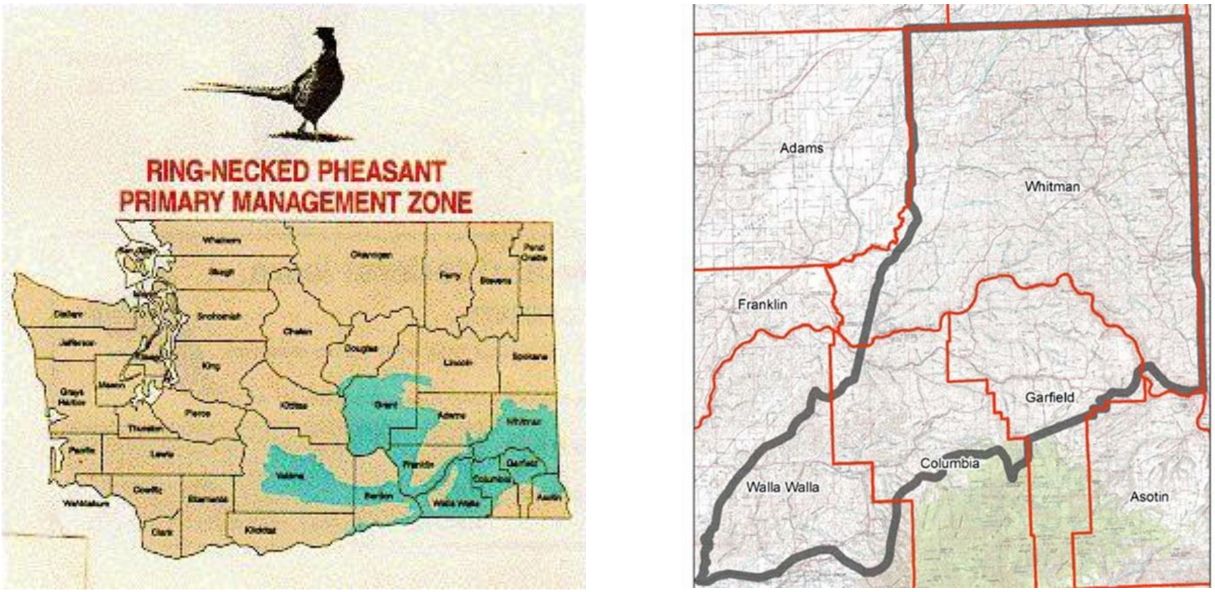


Figure 2: Washington State ring necked pheasant primary management zone (left) and the south east Washington Pheasant Focus Area (right).

Harvest estimates for the Columbia, Snake River, and Yakima Basins have been used to monitor trends within the primary pheasant management zone. The number of pheasants harvested each year reflects decreasing trends in overall populations since 2009 (Figure 3), similar to the statewide harvest trend (Figure 1), though harvest did increase in the last two years.

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.

Harvest increased in two of the three basins in the pheasant management zone in 2018 (Figure 3). The 2018 estimated harvest in the Columbia River Basin was 18,036 pheasants, which is a 5% increase from 2017 and is 8% above the 10-year average. In 2018, the Snake River Basin harvest increased 2% to 15,555, which is 8% below the 10-year average. The Yakima River Basin harvest decreased 20% to 4,438 in 2018, which is 26% below the 10-year average.

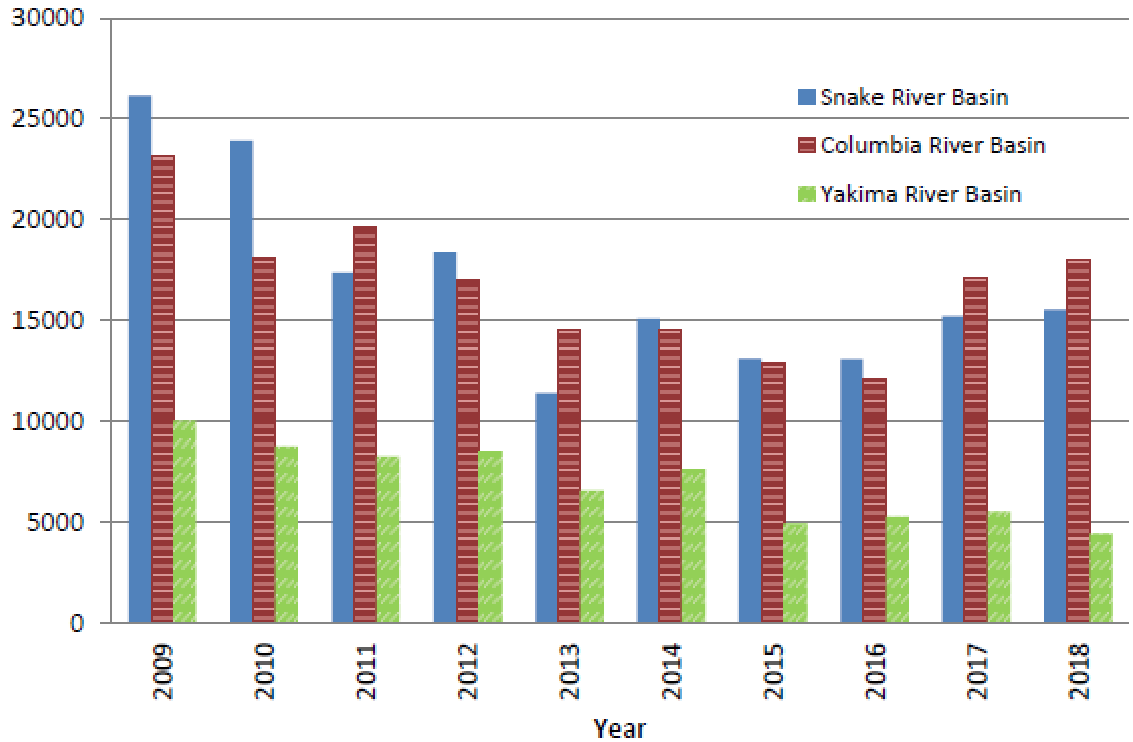


Figure 3. Estimated annual pheasant harvest for eastern Washington river basins between 2009-2018.

Habitat

Permanent cover is critical to pheasant production, particularly where the stands consist of a diverse mix of grasses and broadleaf, flowering plants (forbs). Diverse vegetation can produce more suitable nesting and brood-rearing habitat (Midwest Pheasant Study Group 2013). Research in many parts of the United States indicates that loss of habitat is the primary factor for declining pheasant populations (Labisky 1976, Warner et al. 1984). Of particular importance is the loss of nesting and brood-rearing habitat, winter cover and escape cover to elude predators (Warner 1979). 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.

WDFW leverages multiple programs to improve habitat quality for pheasant and other upland game birds including the State Acres for Wildlife Enhancement (a CRP program), Natural Resources Conservation Service's Voluntary Public Access and Habitat Improvement Program, the Environmental Quality Incentive Program, and others. Private lands biologists provide technical assistance to landowners concerning the installation and enhancement of wildlife habitat. Private Lands biologists 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.

Evolving farming practices, pesticide and herbicide use, and urban sprawl can contribute to declines in pheasant populations. Herbicide application to wheat stubble and reduced stubble height are considered a primary cause of pheasant population decline on the central High Plains (Rodgers 2002). 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 height increases a predator's ability to see pheasants, thus making pheasants more vulnerable. Pesticide use in early spring reduces early germinating plants that are important food resources at that time of year (De Snoo, G. R. and J. De Leeuw 1996). Some insecticides, organophosphates for example, can have a direct effect on individual pheasants by sickening them and/or by killing them (Blus, L. J. and C. J. Henny 1997). Herbicide use reduces 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 within the Columbia Basin and southwest Washington.

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 insect-rich environments for pheasant chicks. Early spring drought conditions, even with normal temperatures, may decrease insect availability. A large portion of pheasant chick diets consist of calorically dense, high protein insects (Savory, C. J. 1989). When Washington experiences cold, wet springs there is a strong likelihood of poor pheasant production.

Population Surveys

Harvest and hunter effort are used as an index to population trends. Surveys (crowing count and brood index) conducted between 1982 and 1998 contributed evidence of the long-term decrease in pheasant numbers in eastern Washington (Rice 2003). These surveys were discontinued due to limited time and funding for district biologists.

In 2018, Washington participated in a pilot brood survey as part of a multi-state research effort led by the National Pheasant Technical Committee and Iowa State University. District biologists surveyed four routes in southeast Washington to contribute data to this project. Project objectives are to account for variable weather conditions during surveys and assess whether corrections may be applied to historical data to improve long-term monitoring.

Management Conclusions

Harvest data indicate that eastern Washington pheasant populations are experiencing a long-term decline, though numbers have recently stabilized. Causes for the decline are not clearly understood, but habitat loss and land use changes are likely the primary causes. Suitable habitats are becoming increasingly fragmented and isolated or have been severely degraded. Diligent monitoring is needed in combination with increased efforts to improve habitat, especially nesting cover and brood-rearing habitat to sustain viable pheasant populations in eastern Washington. Rooster pheasants will continue to be released only as put-and-take enhancement of hunting opportunity, not as a population management tool.

Literature Cited

Blus, L. J. and C. J. Henny 1997. Field studies on pesticides and birds: Unexpected and unique relations. Ecological Applications 7(4): 1125-1132.

Washington Department of Fish and Wildlife. 2003. 2003 Pheasant Workshop - Identification of Key Management Strategies for Washington State: Meeting Summary and Management Recommendations. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, Washington, USA.

De Snoo, G. R. and J. De Leeuw 1996. Non-target insects in unsprayed cereal edges and aphid dispersal to the adjacent crop. Journal of Applied Entomology 120(8): 501-504.

Koepke, Brian Christopher. 2014. Effects of Forb Planting in Conservation Reserve Program on Plant Communities and on Feeding Ecology of Ring-Necked Pheasant (Phasianus colchicus) Chicks. Masters Thesis, Washington State University.

Labisky, R. F. 1976. Midwest Pheasant Abundance Declines. Wildlife Society Bulletin 4(4):182-183. MacMullan, R. A. and L. L. Eberhardt 1953. Tolerance of Incubating Pheasant Eggs to Exposure. The Journal of Wildlife Management 17(3):322-330.

Midwest Pheasant Study Group. 2013. National wild pheasant conservation plan. N.B. Veverka (ed.). Association of Fish and Wildlife Agencies. 111 p.

Quinn, M.A. 2015. Invertebrate Population Responses to Diverse Improvements to CRP. Washington Fish & Wildlife Project 11-1213 Report.

Rice, C.G. 2003. Utility of Pheasant Call and Brood Counts for Monitoring Population Density and Predicting Harvest. Western North American Naturalist.63 (2): 178-188.

Rodgers, R. D. 2002. Effects of wheat-stubble height and weed control on winter pheasant abundance. Wildlife Society Bulletin 30(4):1099-1112.

Savory, C. J. 1989. The Importance of invertebrate food to chicks of gallinaceous species. Proceedings of the Nutrition Society 48(1): 113-133.

Warner, R. E. 1979. Use of Cover by Pheasant Broods in East-Central Illinois. The Journal of Wildlife Management 43(2):334-346.

Warner, R. E., S. L. Etter, et al. 1984. Declining Survival of Ring-Necked Pheasant Chicks in Illinois Agricultural Ecosystems. The Journal of Wildlife Management 48(1):82-88.

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

Chukar and Gray Partridge

Chukar and Gray Partridge Status and Trend Report

STATEWIDE

SARAH GARRISON, Statewide Small Game, Furbearer, and Resident Game Bird Specialist

Management Guidelines and Objectives

Harvest management for chukar partridge (*Alectoris chukar*) and gray partridge (*Perdix perdix*) is designed to provide maximum recreation opportunity without negatively impacting populations. Management goals and objectives are outlined in the WFDW Game Management Plan (WDFW 2014). Additional strategies for enhancing chukar and gray partridge populations are outlined in the Western States Chukar and Gray Partridge Management Guidelines (Knetter et al. 2017) which were developed by a collaboration among western states.

Hunting Seasons and Recreational Harvest

Chukar and gray partridge hunting seasons have varied in length over the years and 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. Beginning in 1997, one standardized season started October 1 and ended the second Sunday in January. The season was changed again in 2003 to start on the first Saturday of October and extend to mid-January which remains in effect today. Additionally, a 2-day youth season occurs in late September. Daily bag limits are six chukar and six gray partridge with 18 of each in possession during the general season.

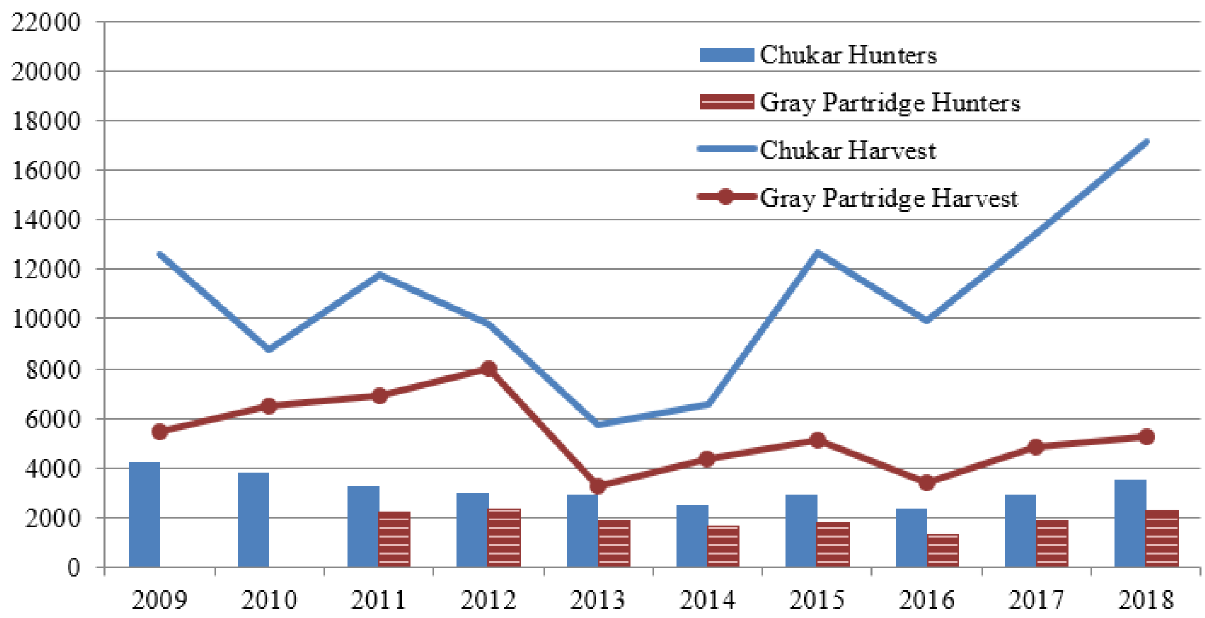


Figure 1. Estimated statewide chukar and gray partridge hunters and harvest for 2008 – 2018.

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. Since the 1970's hunter participation and harvest steadily declined until 2014. Harvest and hunter participation are estimated based on a survey mailed to a stratified random sample of 25,000 hunters. In 2018, chukar harvest was estimated at 17,114 birds. This is a 28% increase from 2017 and is 58% above the 10-year average harvest of 10,838 (Figure 1). Gray partridge harvest increased 7% to 5,238, which is 1% below the 10-year average. Chukar hunter numbers increased 22% from 2017 with an estimated 3,573 hunters participating in 2018, which is 13% above the 10-year average. Gray partridge hunter participation increased 19% from 2017 with an estimated 2,247 hunters participating in 2018. The most productive counties for chukar harvest in 2018 were Yakima (3,766), Chelan (3,327), Asotin (2,433), and Kittitas (2,207) counties.

Estimated chukar harvest for the past ten years in Regions 1, 2, and 3 is illustrated in Figure 2. A map of WDFW regions is available online at wdfw.wa.gov/about/regional-offices. Harvest was above the 10-year average in all three regions in 2018. Estimated chukar hunter participation increased in all three regions from 2017 numbers, and participation is above the 10-year average in Region 2 and Region 3.

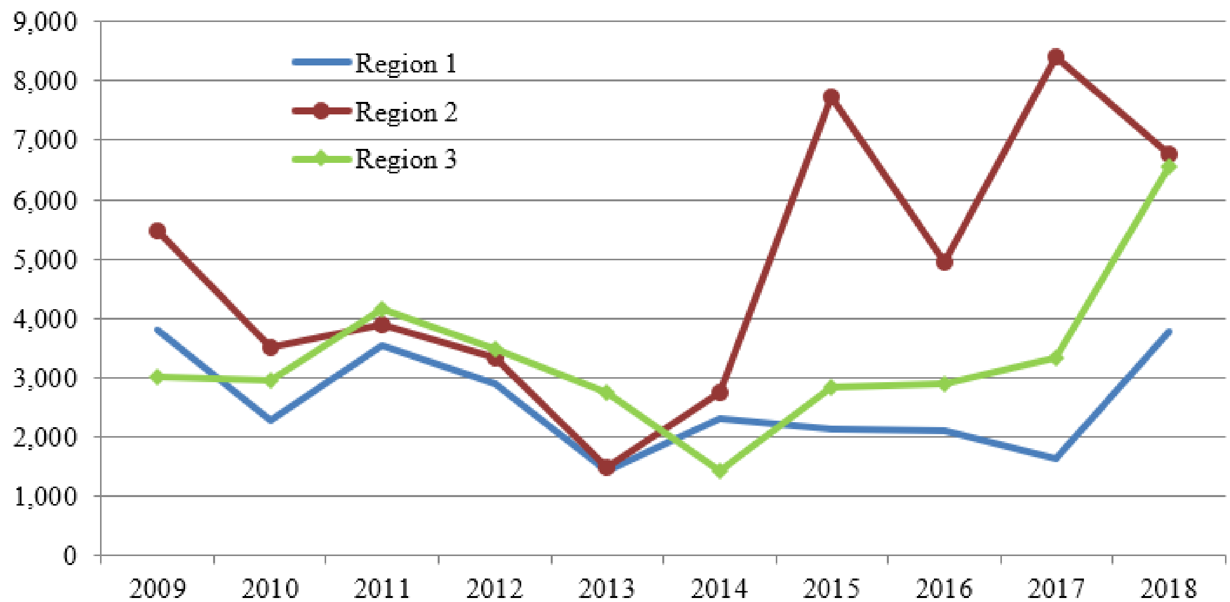


Figure 2. Estimated chukar harvest for Regions 1, 2 and 3 for 2009 – 2018.

Population Surveys

Chukar populations were surveyed by helicopter from 1987 to 1997, when aerial surveys were terminated due to budget constraints. Harvest and hunter effort are used as an index to population trends.

Habitat

Chukar habitat comprises arid areas with steep slopes, deep valleys, and rocky outcrops. This habitat type can be found where topography, combined with shallow soils, has 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 their populations. Encroachment of invasive plants such as yellow star-thistle (*Centaurea solstitialis*), along with fires that eliminate shrub habitat, may be contributing to long-term population declines.

Gray partridge habitat can be found along the "margins" where agricultural fields and native shrub-steppe habitat meet. Their diet consists of cultivated grains, weed seeds such as cheatgrass, and clover. Due to "clean" farming conditions their habitat is decreasing. The Farm Bill and state habitat programs should be investigated and applied to areas where gray partridge and other upland birds would benefit the most.

Management Conclusions

The apparent long-term decline in both chukar and gray partridge populations is likely due to many factors including diminishing habitat quality, hunter participation, and climatic events. 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.

In the last five years, harvest and hunter participation for both species have reversed their downward trajectory and started to increase. Chukar and gray partridge populations can be expected to fluctuate annually in response to weather variability. It is certain that chukar and gray partridge populations in Washington have experienced long-term declines. However, the recent increase in harvest rates indicates the populations may be stabilizing. A continued focus on habitat enhancement should benefit these populations into the future.

Literature Cited

Knetter, J.M., D.A. Budeau, and S.P. Espinosa. 2017. Western States Chukar and Gray Partridge Management Guidelines. Western States Partridge Working Group, Western Association of Fish and Wildlife Agencies, Cheyenne, Wyoming, USA. 32 pp.

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

Quail

Quail Status and Trend Report

STATEWIDE

SARAH GARRISON, Statewide Small Game, Furbearer, and Resident Game Bird Specialist

Management Guidelines and Objectives

The objectives for quail in Washington are to maintain healthy sustainable populations in all suitable habitats within the state and 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. Additional guidelines are outlined in the Western Quail Management Plan (Zornes and Bishop 2009), which was collaboratively produced through the Association of Fish and Wildlife Agencies.

Hunting Seasons and Recreational Harvest

General hunting season for California quail (*Callipepla californica*) and northern bobwhite (*Colinus virginianus*) in eastern Washington typically occurs from the beginning of October to mid-January. A special youth-only hunting weekend occurs in mid-September. The general season has a mixed bag limit of 10 per day with a possession limit of 30. The general season for California quail, bobwhite quail, and mountain quail in western Washington runs from late September through November. Bag limits are the same as eastern Washington, except mountain quail have a daily bag limit of two and a possession limit of four. Mountain quail hunting is closed throughout eastern Washington.

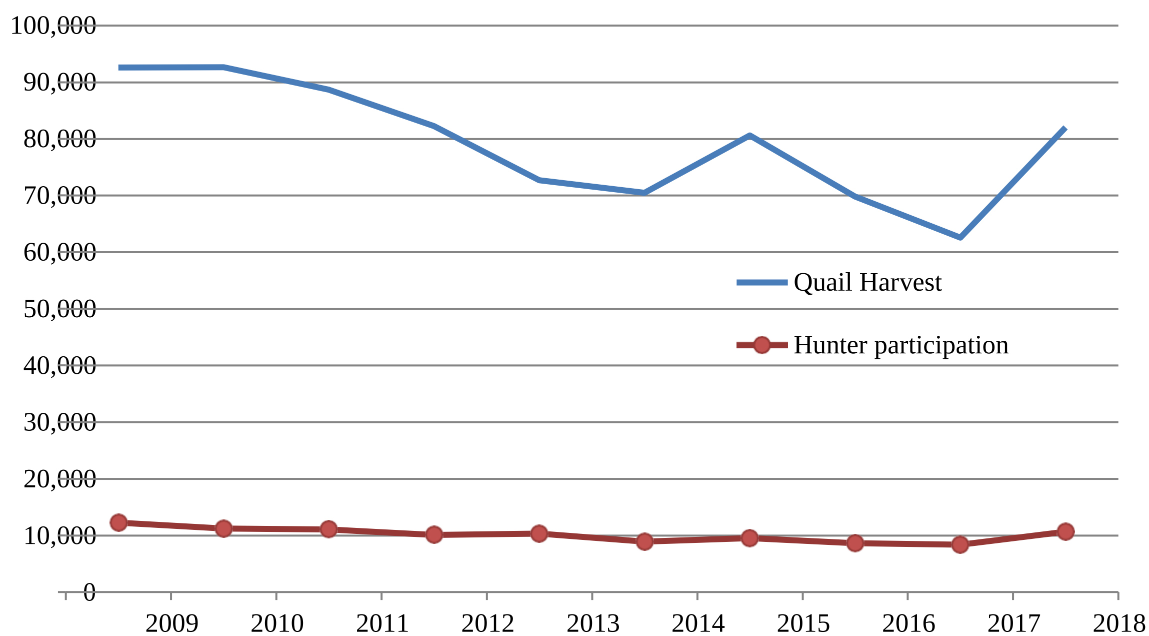


Figure 1. Quail harvest and hunter participation 2009-2018.

Harvest and hunter participation are estimated based on a survey mailed to a stratified random sample of 25,000 hunters. Quail harvest has declined in the long-term from a peak harvest in 2003. However, harvest has increased in two of the past four years (Figure 1). The estimated statewide harvest in 2018 was 81,992 which represents a 31% increase from the 2017 harvest and a 3% increase from the 10-year average of 79,424 birds. Approximately 99% of the statewide total harvest occurred in eastern Washington in 2018. Harvest has averaged about 8 birds per hunter since 2000 (Figure 2).

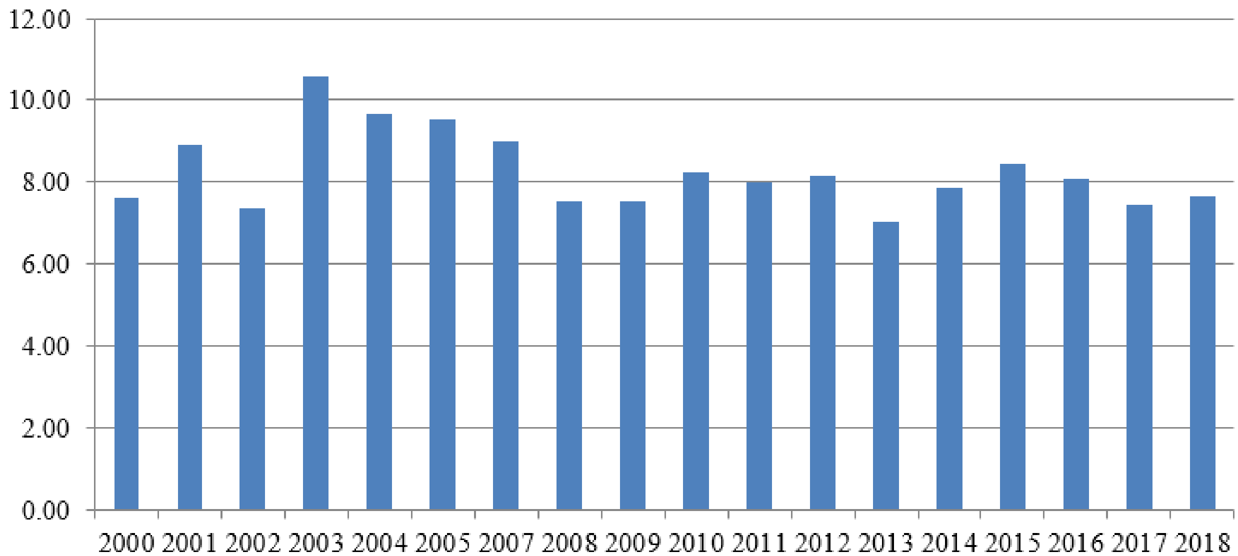


Figure 2. Quail harvest per hunter 2000-2018.

Population 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.

Based on harvest, it appears that quail populations in Washington are currently much lower than they were in the late 1970s and early 1980s. 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. The breeding bird survey (US Geological Survey) information for Washington suggests an increasing trend for California quail populations in the long term (1968-2015) with no clear trend in recent years (2010-2015; Sauer et al. 2017). Another indicator of population is harvest per hunter which has remained fairly stable since 2008 at 8 birds per hunter, with a drop to 7.05 in 2013 reflecting poor spring conditions, and a rebound in 2015 to 8.4 (Figure 2). Given the right environmental conditions quail can be very productive, which may have been the factor that played into the 2015 peak harvest.

Habitat

As with other agriculturally associated wildlife, the quantity and quality of quail habitat has been declining for decades. Breeding habitat (including nesting and brood-rearing habitat), wintering habitat, and habitat that can provide escape cover are important for sustaining quail populations. Land development and "clean" farming practices have dramatically reduced and fragmented suitable habitat for all upland game birds.

A study looking at the food habits of quail was conducted in southeastern Washington (Anthony 1970). The study analyzed 157 California quail crops from March – September. The results showed 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 which subsequently impacts quail populations.

The Conservation Reserve Program (CRP) has benefited Washington 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 they attract. 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 vital for the enhancement of upland bird habitat in eastern Washington.

Population Augmentation

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 the Asotin Creek watershed. A subset of birds were fitted with transmitters for monitoring. Results are documented in a master's theses (Stephenson 2008) and publication (Stephenson et al. 2011). The mountain quail augmentation effort was reinitiated in 2012. A new holding facility was constructed and 143 birds from western Oregon were released in southeast Washington over two years.

Surveys on the small, dispersed populations of mountain quail are not cost effective. Therefore, it is difficult to assess whether the augmentation effort was successful in reestablishing a viable population. Prior to any further releases, a full evaluation of the reintroduction effort will need to take place.

Management Conclusions

Quail are an important upland game bird species and of significant interest to wildlife viewers. Habitat improvements, including the various Farm Bill programs, are vital 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 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.

Literature Cited

Anthony, R. G. 1970. Food Habits of California quail in Southeastern Washington during the Breeding Season. The Journal of Wildlife Management. 34(4): 950-953.

Rodgers, R. D. 1999. Why Haven't Pheasant Populations in Western Kansas Increased with CRP? Wildlife Society Bulletin. 27(3): 654-665.

Sauer, J. R., D. K. Niven, J. E. Hines, D. J. Ziolkowski, Jr, K. L. Pardieck, J. E. Fallon, and W. A. Link. 2017. The North American Breeding Bird Survey, Results and Analysis 1966 - 2015. Version 2.07.2017 USGS Patuxent Wildlife Research Center, Laurel, MD.

Stephenson, John A. 2008. Ecology of Translocated Mountain Quail in Western Idaho and Eastern Washington. Masters Thesis, University of Idaho.

Stephenson, J. A., K. P. Reese, P. Zager, P. E. Heekin, P. J. Nelle, and A. Martins. 2011. Factors Influencing Survival of Native and Translocated Mountain Quail in Idaho and Washington. The Journal of Wildlife Management. 75(6): 1315-1323.

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

Zornes, M, and R. A. Bishop. 2009. Western Quail Management Plan. Association of Fish and Wildlife Agencies. Washington, DC. 92 pages.

Forest Grouse

Forest Grouse Status and Trend Report

STATEWIDE

SARAH GARRISON, Statewide Small Game, Furbearer, and Resident Game Bird Specialist

Management Guidelines and Objectives

Forest grouse in Washington include dusky grouse (*Dendragapus obscures)*, sooty grouse (*Dendragapus fuliginosus)*, ruffed grouse (*Bonasa umbellus*), and spruce grouse (*Falcipennis canadensis*). These four species occur throughout forested lands in Washington. Dusky and sooty grouse were once collectively classified as blue grouse. Management objectives and strategies for forest grouse are outlined in the WDFW Game Management Plan (WDFW 2014) which identifies the following goals:

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.

Hunting Seasons and Recreational Harvest

The current September 1st to December 31st hunting season structure has been in place since 1987. A daily bag limit of three of any of the three species was in place from 1952 to 2009 when the bag limit was raised to four. The decision to increase the bag limit was made to increase opportunity, not because there was an increase in grouse populations. Hunters had been taking approximately 0.4 grouse per day hunted for the past 50 years. Based on this average, management determined 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 four forest grouse to include not more than three blue grouse (dusky or sooty), three spruce grouse, and three ruffed grouse.

Harvest and hunter participation are estimated based on a survey mailed to a stratified random sample of 25,000 hunters. Developing estimates of forest grouse hunter numbers and harvest is challenging because grouse harvest is allowed with a big game license or a small game license.

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 seven years (Figure 1). In 2018, the statewide harvest of 49,014 birds was down 12% from the 2017 harvest and 28% below the 10-year average of 68,033 birds. Estimated harvest increased in four WDFW regions, with the largest increase in Region 5 (19%), while decreasing in Region 1 (44%) and Region 3 (5%). Harvest estimates continue to be tied to hunter participation. In 2018, statewide hunter participation was 20% below the 10-year average of 211,854.

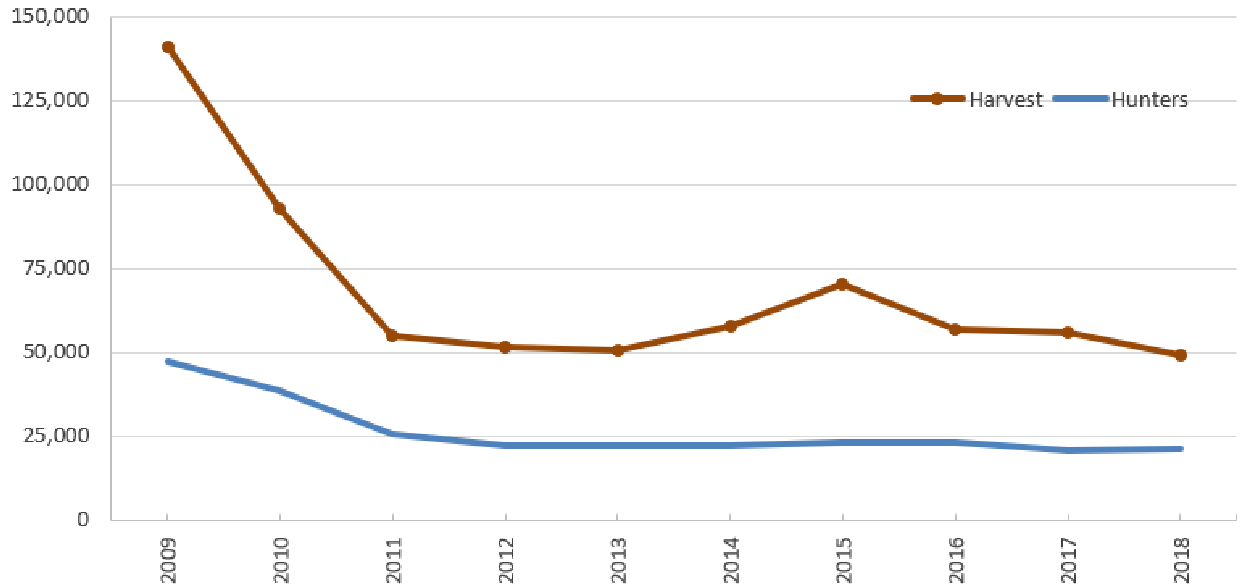


Figure 1: Estimated forest grouse harvest and hunter numbers, 2009-2018.

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 steadily. Estimates of hunter success since 2000 have been higher than, or similar to, the 1980s and 1990s (Figure 2).

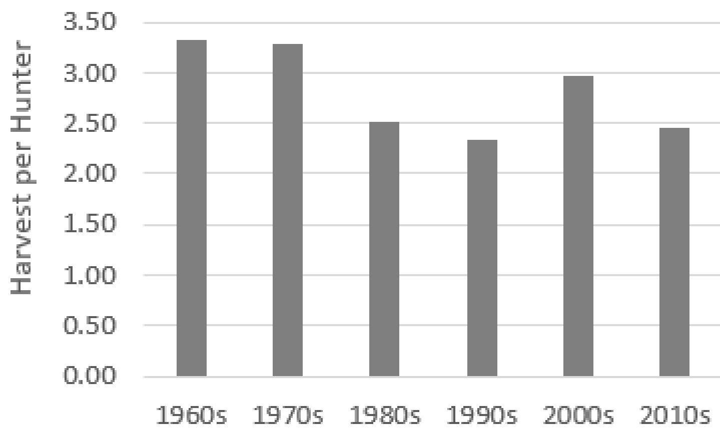


Figure 2: Estimated mean number of grouse harvested per hunter in Washington 1963-2018.

The cause of the long-term harvest declines are not well understood, but reductions in hunter participation are likely a contributor. Loss or changes in forest habitat may also be affecting populations and harvest opportunities. Increased restrictions in motorized travel and new fee permit access programs within industrial timberlands may influence hunter participation and contribute to the downward trend.

Population Surveys

Harvest and hunter effort are used as an index to population trends. Currently, WDFW does not conduct statewide population surveys for forest grouse. However, forest grouse wings were collected in north-central Washington since 1993 by placing barrels out for hunters to voluntarily deposit one wing from each grouse harvested. The collected wings were then classified by species, sex, and age. In 2014, the wing collection effort ended in north-central Washington due to limited time and resources. We initiated a pilot grouse wing and tail collection effort in eastern Washington in the fall of 2016, which has since expanded to western Washington.

Historic statewide wing collection efforts from 1993-2008 provided several pieces of important information. Analysis of these data showed a significant decline in hunting pressure throughout the first month of the hunting season (Schroeder 2010). Therefore, current seasons that extend through December probably have very little impact on grouse populations in the later months. Preliminary results from recent collections support this, with 54% of 2018 samples harvested in September.

In addition, there is a tendency for hunters to misidentify grouse species, which has resulted in forest grouse species being combined in the harvest survey for current harvest estimation purposes. Preliminary results from 2,639 wing samples collected in 2016-2018 indicate that 55% of harvested grouse are dusky or sooty grouse, 36% are ruffed grouse, and 9% are spruce grouse.

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 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

Forest management and wildfire are the most significant factors influencing habitat condition and habitat losses for forest grouse populations statewide. Historically, timber harvest activities have been considered beneficial for most species of forest grouse. Recent changes to silviculture techniques such as using herbicide to control broadleaf species which are considered important food resources for grouse 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, and replanting with tree species that provide fewer habitat benefits can negatively impact grouse populations.

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.

Supplementation of forest grouse populations is generally considered unnecessary in Washington. No large-scale efforts have been made to enhance habitat for forest grouse. However, WDFW Habitat Program staff frequently respond 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. The effect of spring weather on chick production and survival is a well-known factor influencing variation in populations; the range of variation among regions is vast. Changes in access for hunting may also play a role, as this can be attributed to variation within the sample of hunters surveyed from one year to the next, or it could be recent wildfires forced hunters to new locations.

Exploring a variety of survey-based population monitoring techniques may be necessary as well as studying the effect of hunter harvest and changing silvicultural practices. The collection of grouse wings and tails should provide some insights into population structure and allow for improved monitoring of trends over time.

Literature Cited

Schroeder, Michael A. 2010. Progress Report: Harvest Management of Forest Grouse in Washington, with a Focus in North-Central Washington. Unpublished report, Washington Department of Fish and Wildlife.

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

Private Lands Access

Private Lands Access Status and Trend Report

STATEWIDE

CIERA E. STRICKLAND, Private Lands Access Program Manager

Introduction

The Department's Private Lands Access Program promotes cooperation with landowners across the state to provide public access to private property while emphasizing hunting and other outdoor recreational activities. The program's goal is to encourage landowners to provide public access while addressing the costs that landowners incur when allowing the public on their property. A variety of incentives are available to landowners depending upon the property location, habitat(s), and current management of the property. These incentives can include monetary payments, land improvements, or Farm Bill technical assistance. The Private Lands Biologists assist the landowners through this process by serving as the program specialists for the Private Lands and the Farm Bill program. Current program funding is primarily provided by Voluntary Public Access and Habitat Incentive Program (VPA-HIP), grants from the Natural Resources Conservation Service (NRCS) and Pittman-Robertson Wildlife and Sport Fish Restoration funds. The success of the program relies on partnerships with private landowners, sportsman's groups, and volunteers.

Management Guidelines and Objectives

During this reporting period, the Department had active formal hunting access agreements with 533 landowners encompassing more than 1.47 million acres of private land in Washington State (Tables 1 and 2). The majority of enrolled landowners have a formal agreement with the Department; however, some industrial timber managers and/or large land parcel owners often work closely with field staff to facilitate public access for hunters without formal agreements. Properties that do not have a formal agreement are not included in Table 1 or Table 2.

The Private Lands Access Program operates and promotes the following five components of hunting access agreements:

- *Feel Free to Hunt* – This includes private lands where the Department has a management agreement with the landowner or organization to provide public access for hunting with minimal restrictions. This type of agreement provides the most open and unrestricted type of access for the public. Many Feel Free to Hunt properties house a wide variety of small game and big game species and provide ample hunting opportunity. Currently, there are 149 properties, with a total of 660,970 acres enrolled in Feel Free to Hunt agreements across the state.
- *Register to Hunt* – This includes private lands where the Department has a management agreement with the landowner or organization to regulate hunting access by on-site registration. Hunters are required to sign in using a registration slip found at the designated parking area. Parking is usually limited for these properties, to limit the number of hunters. Currently, there are 37 properties, with a total of 24,706 acres enrolled in Register to Hunt across the state.

- *Hunt by Reservation* – This component of the private lands program launched in 2013. It is attractive to many landowners and organizations because it allows access to specific reservation and hunter information via a landowner portal. The Hunt by Reservation program is managed through an online registration system where hunters create an account in order to reserve available properties. The Hunt by Reservation program allows landowners to manage hunting on their lands, without direct contact with hunters. Currently, there are 97 properties, with a total of 103,074 acres enrolled in Hunt by Reservation contracts across the state.
- *Hunt by Written Permission* – This includes private lands where a landowner or organization voluntarily opens their land to public hunting on a contact-for-permission basis. Hunt by Written Permission requires the hunter to contact the Landowner directly, usually by phone, and meet in person to obtain written permission to hunt that property. Written permission is validated by the possession of a written slip, provided to the hunter by the landowner. The Department provides these slips to the landowner at the beginning of the hunting season, and we collect them at the end of the hunting season. The Hunt by Written Permission program allows for the greatest flexibility for landowners and is the most widely used access program. Currently, there are 245 properties, with a total of 574,930 acres enrolled in Hunt by Written Permission contracts across the state.
- *Landowner Hunting Permit (LHP)* – This includes private lands where WDFW negotiates public hunting access to unique and/or high-quality hunting opportunities. Landowners can work with the Department to set customized hunting season opportunities on their property. These opportunities are also advertised annually in the Big Game Hunting Regulations. Currently, there are 5 properties, with a total of 115,393 acres enrolled in Landowner Hunting Permit contracts across the state.

In early 2018, it was determined that the current system that contains the private lands data and information is no longer able to meet both the growing needs of the program and the needs of the public. The Department has made plans to migrate the current system and the corresponding program data into a new and improved platform that will be maintained through a centralized system. Upgrades and developments for the new system began in 2018 and the new system should be completed by fall of 2020.

In 2018, the Department introduced an initiative that focuses on developing strategies for working with large industrial timber companies to acquire access for hunting and other forms of outdoor recreation. The Department is examining existing relationships and analyzing areas with limited private lands access. After the 2019 hunting season, the Department was successful in acquiring more than 627,000 acres of private industrial timber access across the state. The Department currently has 10 active contracts with 10 separate large-scale industrial timber companies to provide no-fee access to these lands. It is the Department's goal to continue to pursue new opportunities for the public regarding access onto private industrialized timberland. The Department will also continue its focus on the development of new relationships and maintaining current relationships with timber companies across the state.

In 2019, efforts began to further expand the Private Lands Access Program to include access opportunities for fishing and wildlife viewing on privately owned land. In the years leading up to this decision, the Department had witnessed a desire from the public to provide opportunities for non-hunting related recreation on privately owned land. The Department also encountered many landowners who expressed a growing concern with the public wanting to access their lands for fishing or other forms of recreation.

Population Surveys

In 2016, we proposed using hunter surveys to gather baseline data for the Reservation System. Unfortunately, due to system issues, we were unable to complete a pre-hunt survey prior to the beginning of the 2017 and 2018 hunting seasons. Post-hunt surveys are still being conducted. Survey response information provides valuable information on user experience, property information, and desired system improvements. Survey responses are monitored by program staff and help guide management decisions and communication efforts with landowners. The post-hunt survey is only available for individuals who reserved and completed a reservation hunt through the Reservation System. This survey is linked to the individual's account and is administered via email. With the launch of the new system, surveys will continue to be a valuable administrative and management tool.

	FY 2019		Change from 2018		Percent Change	
Region	**Cooperators**	**Acres**	**Cooperators**	**Acres**	**Cooperators**	**Acres**
1	276	534,576	299	603,447	-7.69	-11.41
2	118	320,452	128	350,150	-7.81	-8.48
3	53	179,974	39	164,205	35.90	9.60
4	61	159,423	51	163,525	19.61	-2.51
5	14	75,677	15	69,782	-6.67	8.45
6	11	208,971	8	1,105	37.50	18,811.40
State Total	**533**	**1,479,073**	**540**	**1,352,214**	**-1.30**	**9.38**

Table 1: FY19 Cooperators, Acreage, and Change from 2018.

Regional Information and Trends

Program objectives and priorities vary by region. The priorities are dependent on available habitat, species emphasis, 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 represent the full scope of access opportunity. Many properties do not fall into the realm of formal agreements, therefore; those properties are not included in Table 1.

Conservation Reserve Program (CRP)

The U.S. Department of Agriculture (USDA) announced a general sign up for the Conservation Reserve Program (CRP) in December 2019. This is the first-time farmers have had an opportunity to offer acres for enrollment in General CRP since early 2016. The sign up includes an opportunity to offer acres for the State Acres for Wildlife Enhancement (SAFE) initiative of CRP. USDA has not allowed enrollment in SAFE since October 2017. USDA offered SAFE under a Continuous CRP sign up in prior years. Given it has been over three years since USDA offered a General CRP sign up, USDA anticipates demand from farmers will be high. CRP provides habitat for game and non-game animals and often contributes to recreational access opportunities on private lands.

Region 1

There were 276 cooperators and 534,576 acres enrolled in access agreements in Region 1. Region 1 is one of our most diverse regions due to the latitudinal range of the region. This diversity encompasses many different landscapes, which provide unique hunting opportunities throughout the region. Region 1 continues to be a popular area for both upland bird hunting and big game hunting and possesses the largest acreage within the program.

Region 2

There were 118 cooperators and 320,452 acres enrolled in access agreements in Region 2. One of the region's most popular programs is for waterfowl and upland bird hunters. In 2019-2020, funding for the corn stubble hunting program will be unavailable. Hunters may experience a decline in available hunting in this region due to the lack of available funds. This program offered landowners monetary incentives to allow access on croplands where corn stubble is left to provide food resources throughout the winter months for waterfowl. However, the Department is vigorously exploring other funding sources to expand both waterfowl and upland hunting opportunities in this region.

Region 3

There were 53 cooperators and 179,974 acres enrolled in the access agreements in Region 3. A large portion of the acres available in Region 3 are signed up through the Feel Free to Hunt program, primarily for deer and elk hunting. Within Kittitas County, just over 10,000 acres are available through the Hunt by Reservation program on the Puget Sound Energy Wild Horse Wind Facility. The region also enrolled croplands in the corn stubble retention program as described under Region 2, but these properties may also be impacted due to the lack of funding.

Region 4

There were 61 cooperators and 159,423 acres enrolled in access agreements in Region 4. Efforts in this region are largely focused on waterfowl and industrial timber hunting access. Staff also work with landowners to improve access for deer, elk, and bear hunting. In Fall of 2016, the Department extended recreational opportunities by signing agreements with landowners for wildlife viewing. Currently, there are 3 wildlife viewing sites within the Region. The majority of contracts with large acreage parcels are 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 can be extremely popular and hard to reserve. Hunters wishing to reserve these properties are encouraged to do research early. Some private land contracts 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.

Region 5

There were 14 cooperators and 75,677 acres enrolled in access agreements in Region 5. The program in Region 5 has primarily focused on Klickitat County where the majority of the roughly 67,000 acres have been enrolled in the Feel Free to Hunt program providing deer and turkey hunting opportunities. Other agreements within this region also provide upland bird hunting opportunities.

Region 6

There were 11 cooperators and 208,971 acres enrolled in access agreements in Region 6. Opportunities include waterfowl hunting 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. The relationships built between the Private Lands Biologists and private landowners and industrial timber companies have facilitated public access and assisted the landowners with managing public recreation. Work in this area relies heavily on directing volunteer efforts to monitor use, discourage abuse of private lands, conduct cleanup of illegal dump sites, and maintain signage and gates. Much of the private industrial timberland acreage in Region 6 has landowner fee access requirements or is being privately leased. A few of these permit programs have limited hunter numbers. This trend is a growing concern for hunters who are finding it increasingly difficult to locate places to hunt, or they are not willing or able to pay fees for access.

The Department'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. The implementation of fee permits, exclusive leases, or access policies by industrial timberland owners is fast becoming a norm in Washington. As a result of the fee permits, the Department has continued to engage communication efforts with those large landowners. Most of the fee-based permit programs that have been implemented are of relatively high cost and have limited the ability of some hunters to acquire those permits. Presently, the Department does not have the resources to match the income potential of these programs. In some instances, the Department has been successful at encouraging landowners to increase the number of low-cost permits to allow additional 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.

The Department is determined to increase public access and hunter opportunity. As situations and opportunities arise, the Department will continue to pursue funding sources and/or no cost agreements to improve the recreational access for the public across the state of Washington.

Literature Cited

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

Table 2: Access Agreements and Acreage by County.

	Feel Free to Hunt		Hunt by Reservation		Register to Hunt		Hunt by Written Permission		Landowner Hunt Permit		County Totals	
County	Cooperators	Acres	Cooperators	Acres	Cooperators	Acres	Cooperators	Acres	Cooperators	Acres	Cooperators	Acres
Adams	7	6,637					48	115,454			55	122,091
Asotin	3	4,059			2	4,219	9	11,646			14	19,924
Benton	6	15,804			2	8,320	1	12,150			9	36,274
Chelan	2	89									2	89
Clallam											0	0
Clark							1	20			1	20
Columbia	14	26,799					11	21,591			25	48,390
Cowlitz	1	390									1	390
Douglas	7	9,694	1	2,255			27	70,202			35	82,151
Ferry							7	2,572			7	2,572
Franklin	13	17,754	1	381	1	4,500	11	21,871			26	44,506
Garfield	7	6,770	2	939	2	3,674	13	24,163			24	35,546
Grant	5	8,866	2	17,374			18	48,011	1	41,870	26	116,121
Grays Harbor	3	89,139	3	573	2	138	1	353			9	90,203
Island**	4	1,752	1	35							5	1,787
Jefferson			1	118							1	118
King	1	288									1	288
Kitsap											0	0
Kittitas			2	10,080							2	10,080
Klickitat	4	66,568	3	1,605			2	199			9	68,372
Lewis											0	0
Lincoln	6	5,549	1	2,050			20	21,117			27	28,716
Mason	*	87,500									0	87,500
Okanogan											0	0
Pacific	1	31,150									1	31,150
Pend Oreille	3	99,990	1	238			1	120			5	100,348
Pierce											0	0

Table 2: Access Agreements and Acreage by County (Continued)

	Feel Free to Hunt		Hunt by Reservation		Register to Hunt		Hunt by Written Permission		Landowner Hunt Permit		County Totals	
County	Cooperators	Acres	Cooperators	Acres	Cooperators	Acres	Cooperators	Acres	Cooperators	Acres	Cooperators	Acres
San Juan			5	158	2	190					7	348
Skagit	6	376	4	132	8	749	2	86,495			20	87,752
Skamania											0	0
Snohomish	1	160	3	165	5	712	1	10			10	1,047
Spokane	1	4,890	3	2,561			7	4,025	1	2,852	12	14,328
Stevens	*	92,232	2	1,349			14	8,693			16	102,274
Thurston											0	0
Wahkiakum	1	6,636			2	259					3	6,895
Walla Walla	33	59,607	4	11,562			17	19,615			54	90,784
Whatcom	4	436	4	666	10	1,870	*	65,229			18	68,201
Whitman	10	10,118	54	50,833	1	75	27	30,668			92	91,694
Yakima	6	7,717					7	10,726	3	70,671	16	89,114
Totals	**149**	**660,970**	**97**	**103,074**	**37**	**24,706**	**245**	**574,930**	**5**	**115,393**	**533**	**1,479,073**

Human-Wildlife Interaction

Human-Wildlife Interaction Status and Trend Report

STATEWIDE

DAN BRINSON, Wildlife Conflict Management and Prevention Section Manager
RALF SCHREINER, Wildlife Conflict Management and Prevention Program Specialist

Introduction

In recent years, the Washington Department of Fish and Wildlife (WDFW) renewed its focus on human-wildlife conflict management. This report is intended to illustrate efforts to meet the Game Management Plan objectives (WDFW 2014) while creating a historical account of human-wildlife conflict management actions. WDFW has implemented programs that provide opportunities for improved knowledge to develop specific strategies and tools for mitigating human-wildlife conflict in Washington for long-term sustainability of wildlife resources.

Social tolerance can be a limiting factor for species recovery and maintaining sustainable wild animal populations. Negative human-wildlife interactions decrease social tolerance of wildlife populations using otherwise available habitat. Through the application of integrated wildlife management techniques, designed to prevent or mitigate negative human-wildlife interactions, WDFW can increase social tolerance of wild animals. This allows wildlife populations to exist on heavily human influenced landscapes.

Human population expansion, nature-based tourism, and escalating interest in outdoor recreation in Washington, are likely to result in the increasing frequency of negative or unwanted human-wildlife interactions. Maintaining a healthy ecosystem for humans and wildlife will require innovative approaches to minimize conflict. These approaches must include science-based decision making that incorporates public opinion. WDFW is committed to informing and assisting the public to employ proactive measures that provide quick and effective response once unwanted interactions and property damage occur (Conover 2001).

WDFW conducted a Public Opinion Survey that identified 29% of the Washington public experienced negative situations or problems associated with wildlife (Duda et al. 2014). Deer and raccoons were the most commonly named species causing problems (35% and 25%, respectively), followed by bear (14%), geese (13%), and coyotes (10%; Duda et al. 2014).

WDFW does not regularly conduct formal assessments of human-wildlife conflict complaints. Current trends indicate that human-wildlife conflict resolution in Washington is a management necessity and traditional recreational harvest is not always effective in resolving negative interactions.

Management Guidelines and Objectives

In December 2014, WDFW published the Game Management Plan (WDFW 2014) which outlined three goals and 10 human-wildlife conflict management objectives with strategies designed to create an integrated system of management actions, data collection, and information sharing.

The goals for human-wildlife conflict management in Washington are to:

1) Improve our understanding and ability to predict human-wildlife conflict issues;
2) Enhance proactive measures to prevent negative human-wildlife interactions and improve agency response to interaction events; and
3) Minimize, mitigate, and manage negative human-wildlife interactions to maintain/increase human tolerance and perpetuate healthy and productive wildlife populations.

Management Actions

WDFW management actions are designed to minimize negative human-wildlife interaction and assist landowners with prevention, mitigation, and when necessary, compensation for property damage or loss (as provided by law). An effective strategy for managing human-wildlife conflict is to allow staff a degree of flexibility to test new techniques while improving existing preventative and mitigation tools. WDFW Wildlife Conflict Specialists assess each scenario and use their professional judgment to determine the best course of action for interaction resolution.

When traditional recreational harvest cannot resolve human wildlife conflict issues, WDFW needs to employ other tools. WDFW has used hunters to assist with deer, elk, and turkey damage issues and hound handlers and trappers, to assist with bear and cougar depredation events. In each case, there are criteria to meet and restrictions that direct the final disposition of the animal harvested.

WDFW continues to use a three-category system to respond to human-wildlife conflict issues: 1) public safety response, 2) non-public safety requiring assistance, and 3) self-help. Self-help involves referring a customer to the WDFW website to obtain an answer to a wildlife-related nuisance problem, directing the customer to a list of certified Wildlife Control Operators available for hire, or directing the customer to contact the United States Department of Agriculture Wildlife Services for help in solving a conflict situation. Often the self-help tools are used to assist with damage situations involving small game, furbearers, and unclassified species (e.g., raccoons, beavers, coyotes, etc.). The WDFW Law Enforcement Program is the primary contact for interactions affecting public safety that involve bear, cougar, moose, and wolves. Non-public safety wildlife conflicts, including depredations involving deer, elk, turkey, black bear timber damage, and sometimes wolves, are generally resolved through the WDFW Wildlife Program.

Deer, Elk, and Turkey Damage Prevention and Kill Permits

Depending upon the circumstances, landowners may enter into a Damage Prevention Cooperative Agreement (DPCA) with WDFW to use non-lethal mitigation tools for damage caused by deer, elk, and turkey. If these mitigation tools are ineffective, a Wildlife Conflict Specialist may issue a Damage Prevention Permit (DPP) or a Kill Permit (KP) to a landowner that allows the removal of one or more animals using licensed hunters or agency kill authority. During the 2018 damage season (April 2017–March 2018), a total of 2,440 permits were issued to remove offending deer, elk, and turkey (Table 1).

Table 1. Total damage prevention permits (DPP) and kill permits (KP) issued by Washington Department of Fish and Wildlife Region for deer, elk, and turkey, April 2017–March 2018.

Permit	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Total
DPP Deer	373	12	107	18		23	**533**
KP Deer	174	9	26	24	1	31	**265**
DPP Elk	82	4	578	12	65	121	**862**
KP Elk	241	19	78	59	41	117	**555**
DPP Turkey	-	6	-	-	-	-	**6**
KP Turkey	199	20	-	-	-	-	**219**
Total	**1,069**	**70**	**789**	**113**	**107**	**292**	**2,440**

Licensed hunters with a DPP must purchase a Damage Tag to participate in a deer or elk damage resolution hunt and may retain the deer or elk. Hunters purchased 982 deer and elk Damage Tags during the 2018 damage season; of those Damage Tag holders who reported, 443 deer and elk were harvested for an estimated success rate of 23% statewide (Table 2).

Table 2. Total reported harvest by hunters with deer and elk Damage Tags for each Washington Department of Fish and Wildlife Region, April 2017–March 2018.

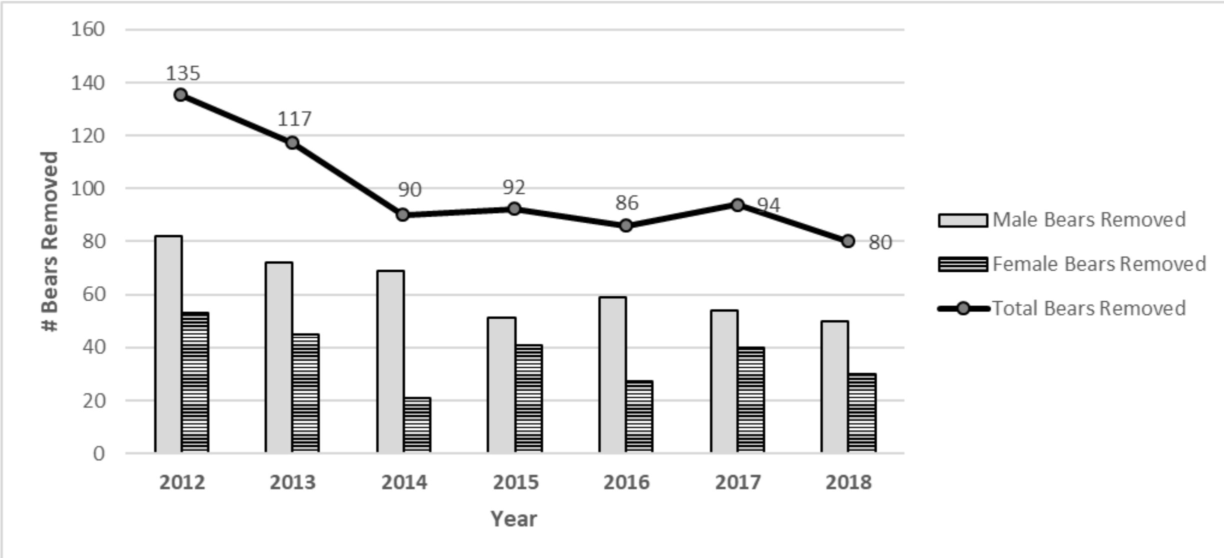
Damage Tag Type	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Total
Deer	192	5	48	5	-	4	**254**
Elk	18	2	114	4	17	34	**189**
Total	**210**	**7**	**162**	**9**	**17**	**38**	**443**

Black Bear Timber Damage

Black bears emerge from winter dens when food sources are relatively scarce and may strip bark off certain species of trees to access the carbohydrate-rich cambium. Bark stripping or "peeling" may hinder the growth of the tree or kill it, causing a potential financial loss to commercial timber growers. The damage period occurs from approximately April through June and ends once other food sources, such as berries, become more abundant.

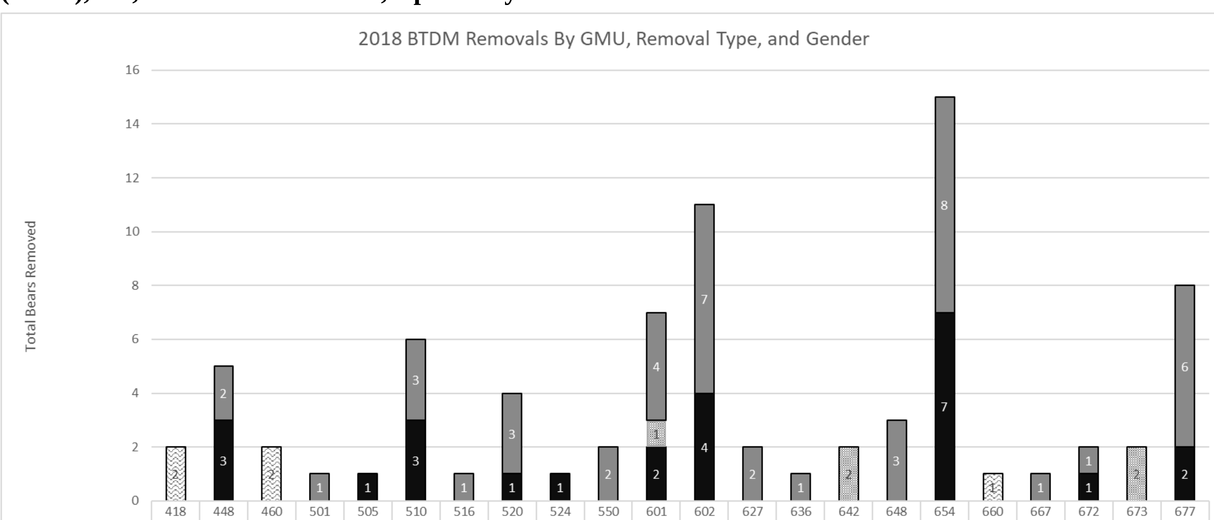
Commercial forest landowners and managers experiencing timber damage caused by black bears may request a black bear timber damage depredation permit. This permit request requires evidence of damage from the landowner/manager, typically in the form of a date-stamped photograph, and must specify the damage location, requested removal method, and who will participate on the permit. The number of depredation permits issued (123 permits in 2012 and 84 permits in 2018) and the number of bears removed (Table 3) varied from 2012–2018 but have generally declined.

Table 3. Number of male and female black bears removed annually during the bear timber damage period, 2012–2018.



A total of 80 bears were removed during the 2018 timber damage period, including 50 males (62.5%) and 30 females (37.5%). Bears were removed using a variety of methods, including hound hunting, trapping with snares, and Master Hunters (Table 4).

Table 4. Number of bears removed during the black bear timber damage period by Game Management Unit (GMU), sex, and removal method, April–July 2018. MH = Master Hunter



	418	448	460	501	505	510	516	520	524	550	601	602	627	636	642	648	654	660	667	672	673	677
Males By Snare	2		2															1				
Males By Hound		2		1		3	1	3		2	4	7	2	1		3	8		1	1		6
Female By Snare											1				2						2	
Females by Hound		3			1	3		1	1		2	4					7			1		2

The total black bear harvest for 2018, including the total recreational harvest, the spring permit hunt, and bear timber damage removals was 1,621 bears statewide. Females represented 35% of the total statewide harvest. Black bear timber damage removals represented 5% of the total statewide harvest.

Carnivore (black bear, cougar, and wolf) Depredation on Livestock

Accounts of managing and response to livestock losses and injury caused by black bears and cougars are described under those sections. Please see the Wildlife Damage Claims section below for detail regarding compensation claims during fiscal year 2018.

Cost-share and Prevention Measures for Livestock Losses

WDFW offers cost-sharing with livestock producers for deploying conflict prevention measures. Producers that sign a Damage Prevention Cooperative Agreement for Livestock (DPCA-L) may receive cost-share funds to assist them with installing and using non-lethal conflict prevention tools. The DPCA-L Agreements identify non-lethal measures a producer can use to minimize livestock loss to wolves. The agreements can last up to one year. They may be signed at any time during a fiscal year and end at the close of the fiscal year. Potential prevention measures that may be included in a DPCA-L include: Sanitation (fencing bone yards, surrounding carcasses with fladry, or removing carcasses), providing deterrence tools (screamers, range riders, guard dogs, radio-activated guard boxes, fladry, predator fencing, electric fencing, and bio fencing), and protecting livestock rearing areas. The most common measures deployed by producers under DPCA-Ls are range riding and sanitation. Cost-share amounts can vary depending on the livestock operation, location of the livestock herd in relation to wolves, proactive measures selected, and duration. During fiscal year 2018 (July 1, 2017 – June 30, 2018), there were 34 DPCA-Ls written with livestock producers statewide.

In addition to the DPCA-Ls, WDFW also contracts Range Riders to assist ranchers with minimizing livestock losses caused by wolves. Range riders are skilled at assessing potential wolf presence in the vicinity of livestock. They provide consistent human presence with livestock while on grazing allotments. Range rider duties include, but are not limited to: monitoring the health and behavior of a herd; seeking out signs of wolf or other carnivore activity in the area; implementing tools and techniques that minimize predation risk; deploying non-lethal hazing techniques; trying more intensive livestock management, or any number of other techniques or combination of techniques. This requires frequent communication with the livestock producer and WDFW staff regarding planned livestock movements and grazing plans. During fiscal year 2018, WDFW had 10 range rider contracts with up to 17 different riders throughout the year.

Wildlife Damage Claims

<u>Agriculture</u>

Commercial agriculture producers who meet the definition of "eligible farmer" (Revised Code of Washington 82.08.855), have cooperated with WDFW prior to claim initiation, 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) 220-440-140 and 220-440-150] and the availability of specific funding for this purpose. Reimbursement for damage claims is not guaranteed. The total compensation paid for deer and elk crop damage claims in fiscal year 2018 (July 1, 2017 – June 30, 2018) was $129,777.65.

<u>Livestock</u>

Additionally, commercial livestock producers who experience livestock loss caused by bear, cougar, or wolf may be eligible for compensation under WAC 220-440-170. Similar to the deer and elk claims, payment is conditional upon meeting specific criteria and the availability of specific funding for this purpose. Reimbursement for damage claims is not guaranteed. The total compensation paid for direct livestock losses (i.e., losses determined by WDFW to be confirmed or probable) caused by wolves in fiscal year 2018 was $13,489.40. The total compensation paid for direct livestock losses caused by cougars in fiscal year 2018 was $5,155.00. Additionally, we are exploring improvements to the Department's livestock loss compensation program with a recently established stakeholder group.

In the latter part of fiscal year 2016, the WDFW established an independent, five-member Livestock Review Board (LRB) to evaluate claims and make recommendations to WDFW for indirect livestock losses due to harassment by wolves. This includes greater than normal losses, reduced weight gains, and reduced pregnancy rates in livestock. The LRB consists of two livestock producers, two members from the environmental community, and a rangeland scientist. The Department carefully evaluates and considers the recommendation from the LRB when considering settlement of an indirect livestock loss claim.

Wildlife Control Operators

Wildlife Control Operators (WCO) are private individuals who are certified by WDFW to assist landowners in the prevention or control of wildlife-related damage and charge a fee for their service. A WCO is allowed to harass, control, and/or trap various small game, furbearer species, unclassified wildlife, and predatory birds. WCOs are not certified to handle nuisance issues involving deer, elk, cougar, bear, moose, wolf, bighorn sheep, mountain goats, turkeys, or protected and endangered wildlife.

The WCO program is administered through the Wildlife Conflict Management and Prevention Section. Classes for WCO certification are held four times a year, alternating between the Olympia and Spokane WDFW offices. Once a person meets all the requirements for becoming a WCO (WAC 220-440-100) and completes and passes WCO training, they are presented with a certificate that is valid for three years. The permit allows the individual to handle specific nuisance wildlife issues year-round and state-wide. There were 27 people who completed training and were certified as WCOs in 2017, compared to 50 people in 2016. Beginning March 2016, a revision to WAC 220-440-100 went into effect. It stipulates that a prospective WCO must demonstrate two years of trapping or wildlife damage management experience before they can take the WCO class and apply for WCO certification. Methods of documenting experience include, but are not limited to, possessing a trapper's license for two years, providing a letter of recommendation from a currently certified WCO or trapper, providing evidence of being employed in the wildlife abatement field for two years, providing a written statement verifying they are currently working with a certified WCO, or other method as identified by the Department. The more stringent requirements under the revised rule explain the reduction in certifications between 2016 and 2017. Currently, there are 170 people in Washington State with valid WCO certificates.

Special Trapping Permit

Property owners who are experiencing wildlife-related damage to their property are allowed to mitigate the problem by capturing and/or removing the species responsible, with exceptions. In some cases, when nonlethal measures have been deemed ineffective, a property owner may apply for a Special Trapping Permit (STP), which is valid for 30 days and authorizes the use of one or more body-gripping traps. Body-gripping traps that may be authorized under a STP include a Conibear-type trap in water, a padded-jaw leg-hold trap, and a non-strangling foot snare.

During 2018, 502 Special Trapping Permits (STPs) were issued statewide which allowed for removal of certain wildlife causing damage to public or private property. The 2018 value shows a slight decrease from the 540 permits issued in 2017. The most common authorization requested was for trapping mountain beaver within industrial timberlands.

In 2018, requests for STPs and corresponding wildlife removals were variable by month, but the highest numbers generally occurred fall through spring. Special Trapping Permit requests and the number of animals removed using STPs were highest in western Washington counties.

Table 4. Total number of individual animals reported trapped for the six most common wildlife species removed using Special Trapping Permits in 2018.

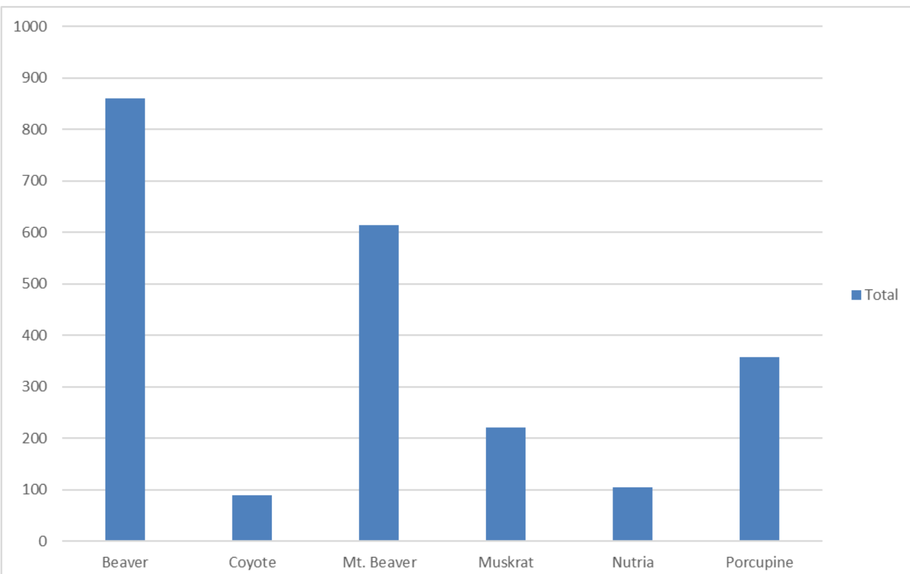
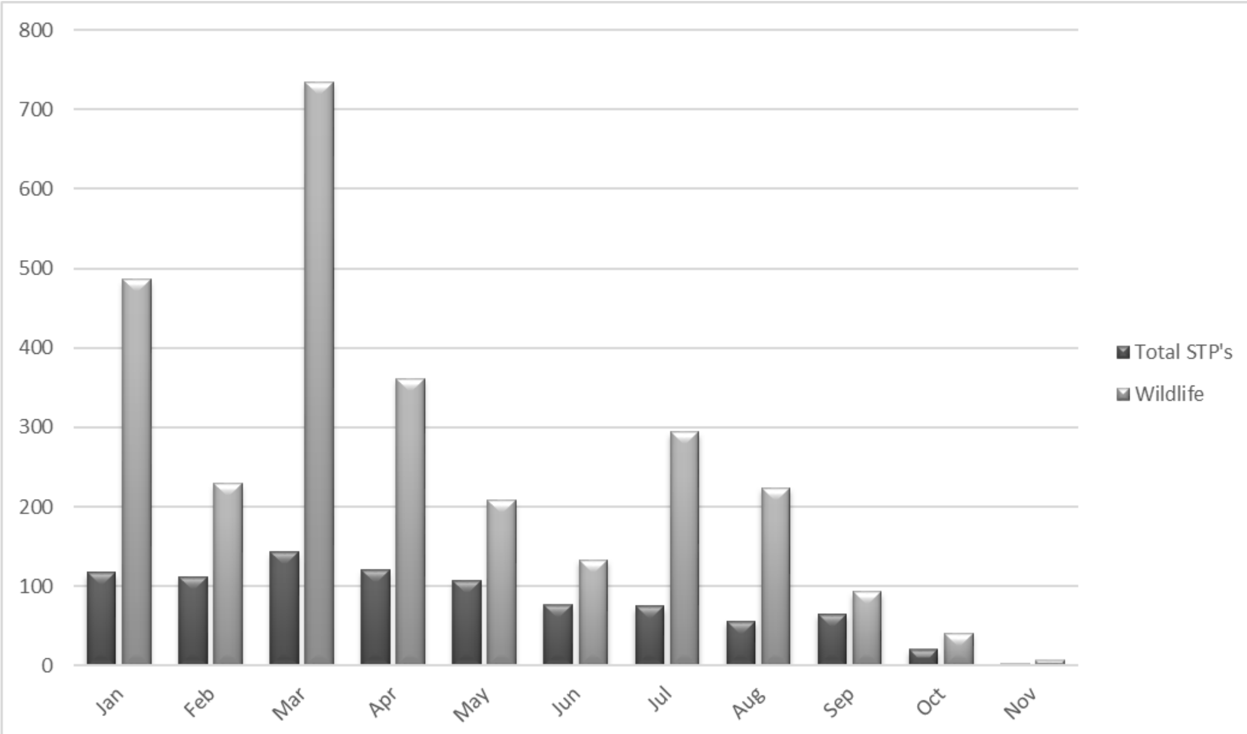


Table 5. Total number of wild animals reported trapped with Special Trapping Permits (STP) and the total STPs in each month, 2018. The number of wildlife reported trapped in each month is based on reporting for 30-day permits that ended within a given month.



Management Conclusions

Minimizing the potential for negative human-wildlife interaction is a critical key to North American wildlife management in the 21st century. Doing so increases the social tolerance of wildlife utilizing habitat that might otherwise be unavailable to many valuable species including big game. Managing and preventing wildlife conflict requires the use of a variety of adaptable tools and techniques to ensure sustainable wildlife populations without negatively impacting our natural resources or the livelihoods of Washington residents. Food resources, such as agriculture crops, livestock, or unnatural attractants in the vicinity of residences, are the motivating mechanism for potential conflict. During 2015, WDFW improved data collection methods, increased response to conflict issues, deployed new methods and techniques for managing conflict, and increased information sharing for mitigating negative encounters. The WDFW Wildlife Conflict Management and Prevention Program is committed to its continued improvement of managing negative human-wildlife interactions using a combination of best science and best business practices. Some of the remaining challenges for effective human-wildlife conflict management include: 1) improving rules that address the primary conflict issues, 2) developing policies and procedures that facilitate a smooth process by which actions can be deployed, and 3) furthering appropriate data collection to direct management activities, and 4), testing new and evaluating existing wildlife management techniques targeted to mitigate or prevent conflict. An additional challenge and objective for the future is improving outreach and information sharing through the use of multimedia approaches (e.g., print, audio, and visual, and social media platforms).

Literature Cited

Conover, M. R. 2001. Resolving human-wildlife interactions: the science of wildlife damage management. Lewis publishers, Boca Raton, Florida, USA.

Duda, M. D., M. Jones, T. Beppler, S. Butzen, S. J. Bissell, A. Criscione, P. Doherty, G. L. Hughes, P.E., E. Meadows, A. Lanier. 2014. Washington Residents' Opinions on Bear and Wolf Management and Their Experiences with Wildlife That Cause Problems. Conducted for the Washington Department of Fish and Wildlife by Responsive Management.

Washington Department of Fish and Wildlife. 2014. July 2015–June 2021 Game Management Plan. Wildlife Program, Washington Department of Fish and Wildlife, Olympia, Washington, USA.