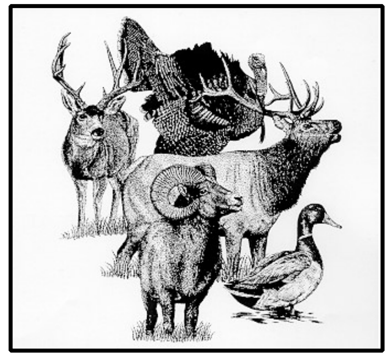
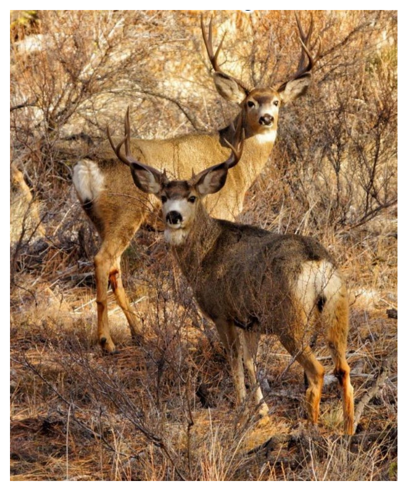
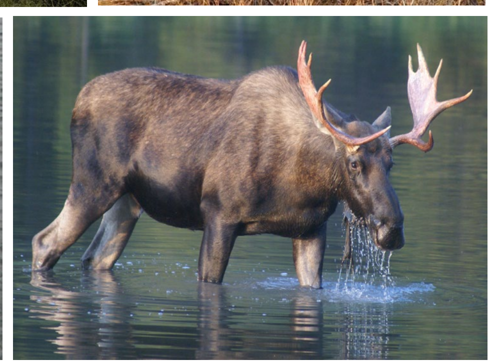
STATE OF WASHINGTON

2022 Game Status and Trend Report







Washington Department of FISH and WILDLIFE

AN OFFICIAL PUBLICATION OF THE STATE OF WASHINGTON

2022 GAME STATUS AND TREND REPORT

July 1, 2021 – June 30, 2022

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.

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Deer

Blue Mountains Mule Deer Management Zone

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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). GMU 157 is closed to human entry with no mule deer harvest opportunity.

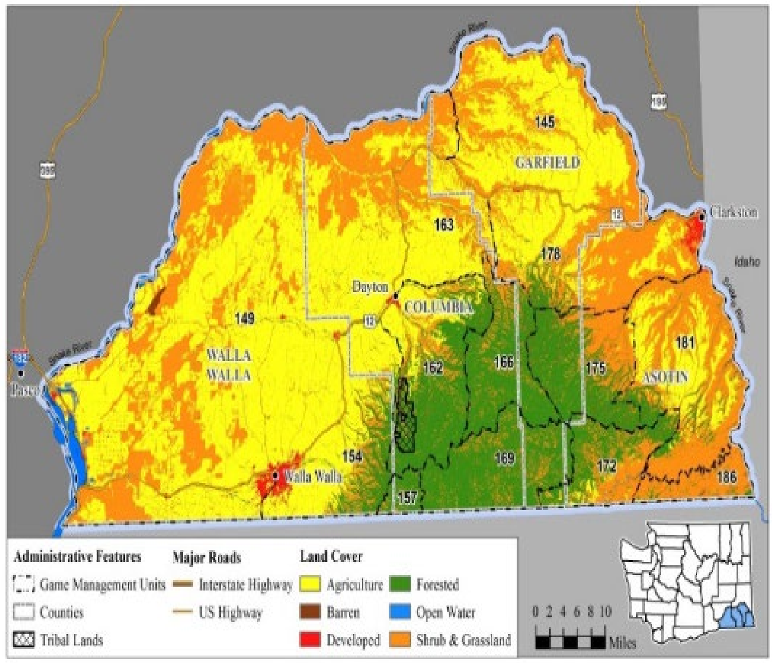


Figure 1. GMUs and generalized land cover types within the Blue Mountains MDMZ.

Management Guidelines and Objectives

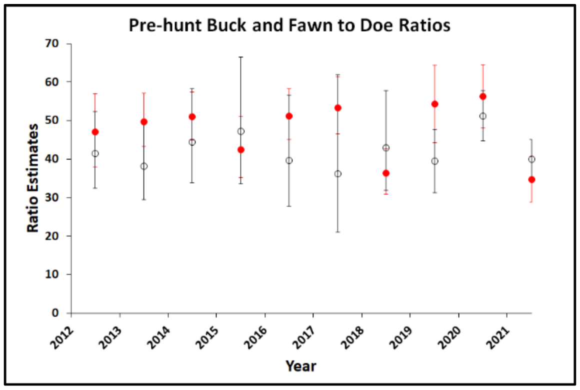
The Department's objective within this MDMZ is to maintain a stable population based on abundance and harvest estimates. Additional management objectives include managing for a post-hunt population with a sex ratio of 15-19 bucks:100 does in predominantly agricultural areas, and 20-24 bucks:100 does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

Population Surveys

WDFW conducted the last two population surveys in 2017 and 2018 following sightability protocols (procedure to statistically estimate a population in the survey area) in the area of greatest winter mule deer concentrations. This area is generally north of State Hwy 12, from Alpowa Creek on the east side of District 3 across to Wallula Junction. While the Department had initially planned for three years of abundance estimate surveys, consistent results from the first two large-scale surveys indicated the survey methodology was sound and did not require further verification. WDFW will likely conduct future survey efforts on a 5-7-year rotation in conjunction with using integrated population models (IPM), which are currently being investigated.

Population Survey Details

In addition to population surveys, WDFW collects annual pre- and post-hunt herd composition data to monitor buck:doe ratios and fawn:doe ratios. In addition, biologists conduct surveys for buck:doe ratios in August and Nov-Dec for pre- and post-hunt estimates, while fawn:doe surveys are conducted in September and Nov-Dec (Figure 2a and 2b).

a) 

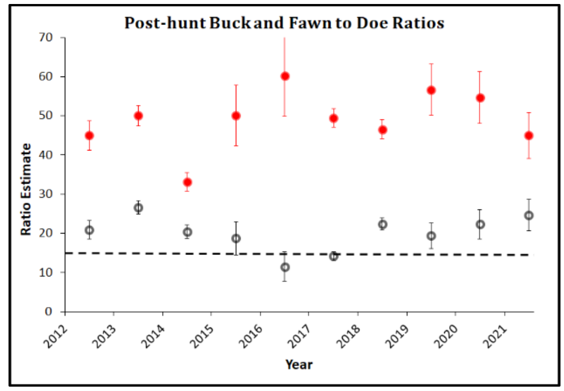
b) 

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, 2012–2021. Dashed line is the lower target for post-hunt buck ratios.

Hunting Seasons and Recreational Harvest

Harvest estimates from the 2012-2021 general seasons (Figure 3a) have been variable over that 10-year time frame but had exhibited a recent recovery to the 10-year mean before last year's decline correlated with hemorrhagic disease and public land fire closures. While hunter effort (hunter days; Figure 3b) has remained consistent, harvest rate (HPUE; Figure 3b) has mirrored recent upward trends in total harvest after a 2017 low. Last year showed a steep decline despite fewer hunter days, indicating harvest dropped at a higher rate than hunter days. Again, this recent variability can likely be attributed to hemorrhagic disease directly affecting mule deer numbers and public land closures affecting hunter days. Some effects could be related to increased mule deer antlerless permits being offered in GMUs 145 and 149, which puts pressure on the female segment of the population. However, available antlerless permits have decreased yearly since 2017, which appears to have improved the general season harvest up until last year.

GMU 149, on average, accounts for 33% of the total District mule deer harvests, and changes in this GMU have the greatest impact on the overall trends across the District. Harvest in 2021 showed a steep decline in both hunter success and HPUE. This GMU is almost entirely private land and was not subject to fire closures, indicating that the harvest decline can be directly correlated with the incidence of hemorrhagic disease. Mortality detections in radio-collared mule deer indicate mortality rates as high as 15%. It is important to note that hunter days and HPUE represent time hunting for both white-tailed and mule deer, so estimates are likely to be slightly higher than actual harvest rates.

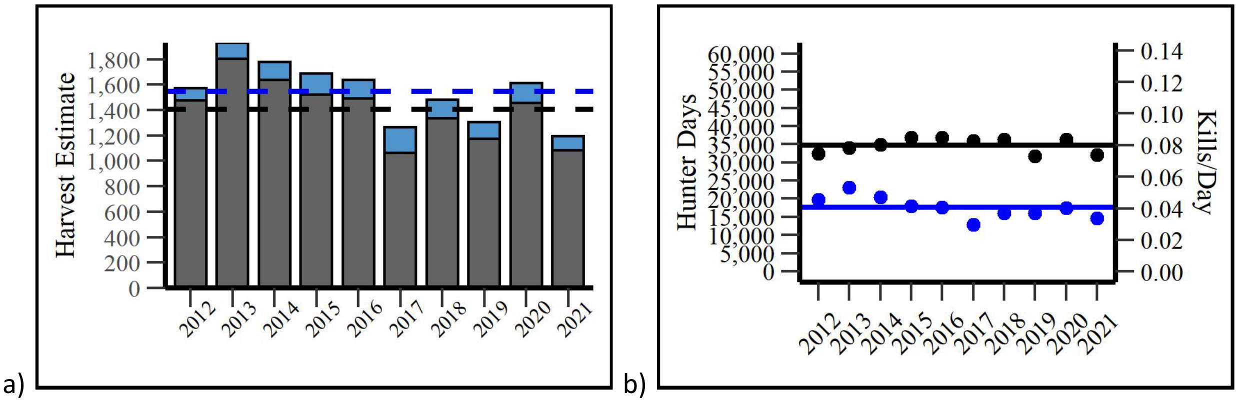


Figure 3. Harvest estimates (columns) and 10-yr means (dashed lines) for: a) General BM Zone Harvest (gray) and Permit BM Zone Harvest (blue) and: b) general season estimates (points) and 10-yr means (solid lines) for hunter days (black) and harvest/unit effort-days (blue) in the Blue Mountains MDMZ, 2012–2021.

Survival and Mortality

No estimates of pregnancy or survival rates are available for mule deer herds in the Blue Mountains MDMZ. Since 2019, biologists have been maintaining approximately 50 radio-collared does across the recent population survey area, which should provide information on doe survival and identify range and movement patterns. In addition, a graduate student is analyzing location data and habitat associations and determining fawning status from a subsample of radio-collared does. Biologists identified high mortality during the first full winter of collar deployments, likely related to severe late winter conditions resulting in poor body condition and predation. During summer 2021, eight collars were re-deployed after being retrieved from mortalities, and there are currently 35 working collars on mule deer across District 3.

In addition to 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, disease, and poaching can also be significant causes of mortality. While these mortality sources may influence population abundance, habitat condition and availability likely have the greatest impacts to mule deer populations, particularly here in the Blue Mountains MDMZ where most of the deer population is concentrated at lower elevations and is likely to be summer range limited. Summer range habitat conditions will influence population dynamics by affecting doe body condition, which will influence fawning rates and survival.

Habitat

Limited habitat is the major impediment to increasing deer numbers and hunting opportunities within the Blue Mountains MDMZ. The Blue Mountains MDMZ has been altered by landscape changes, including conversion to croplands, wildfire suppression and burning (positive and negative), road construction, invasion of noxious weeds, extensive wind power development, and urban-suburban development. Solar development is another emerging threat to habitat, with over 3,000 acres proposed for development in Garfield and Asotin Counties. Although no single factor has had a direct, large-scale effect on mule deer populations in the Blue Mountains, the cumulative impact of such alterations has likely been detrimental to mule deer habitat and populations over time.

Human-Wildlife Interaction

The agricultural damage prevention program managed by WDFW changed approximately ten 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. Qualifying landowners are allowed two 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 requiring the landowner, leaseholder, or their designee to purchase a damage tag and report their harvest through the licensing system. Conflict biologists reported 14 hunters successfully filling kill permits between July 2021 and March 2022, including four mule deer does and two bucks causing damage to orchards; the remaining tag-holders harvested a white-tailed doe. Six hunters reported hunting their damage tag, with three unsuccessful, two harvesting mule deer does, and one white-tailed doe harvest. Most hunts occurred in GMU 149 and 154 in areas with minimal hunting opportunities, 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. The biggest management concerns are habitat alteration and the 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. Still, 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 actions WDFW can undertake to maintain habitat for mule deer across the District. A portion of the mule deer reside in the mountain units, where long-term harvest trends show a generally declining population. Some of this is likely due to habitat changes brought about by fire suppression, but recent wildfire activity, controlled burns by the USFS, and forest thinning projects on State and Federal lands may help improve habitat conditions. However, population response to these habitat alterations has not been observed. WDFW is continuing to monitor the population's mountain segment through harvest metrics.

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 2021 surveys documented a ratio within the objective range (15-19 bucks/100 does post-hunt). Fawn:doe ratios, while highly variable throughout the different habitats of the District, remain within the range that supports a stable to increasing population (40-60 fawns/100 does), 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 very 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 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 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.

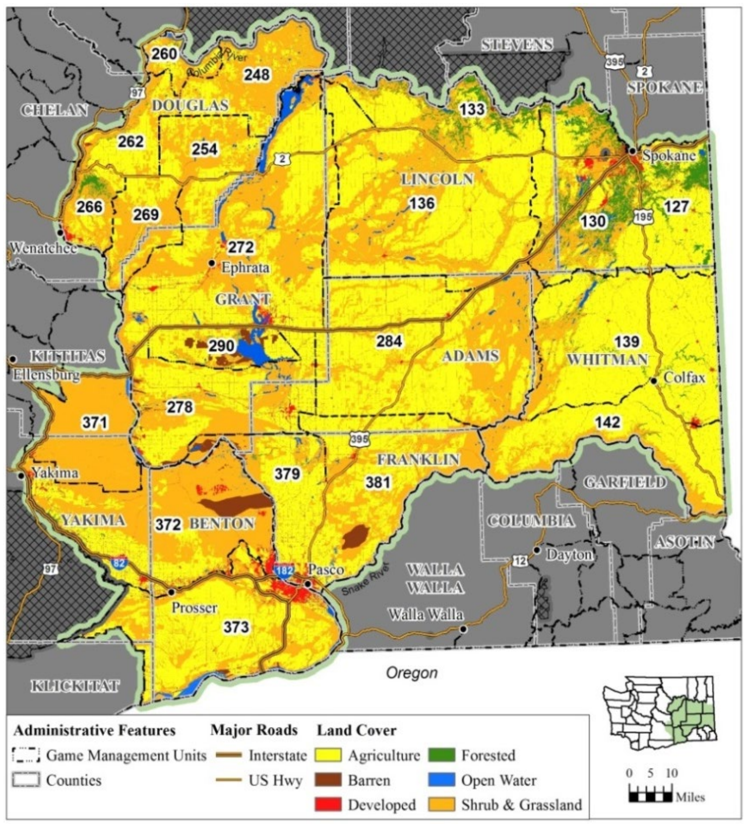

Figure 1. GMUs and generalized land cover types within the Columbia Basin MDMZ.

Management Guidelines and Objectives

The Department's objective within this MDMZ is to maintain a stable population. Population status is evaluated using 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. Post-hunt population management objectives are for a sex ratio of 30 bucks per 100 does, which is maintained via limited-entry drawing permit opportunities.

Population Surveys

Mule deer are present throughout most of the Columbia Plateau MDMZ at varying densities. The highest densities are seasonally associated with irrigated cropland with adjacent shrub-steppe or riparian habitat, and the lowest densities are associated with large monotypic blocks of either dryland 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.

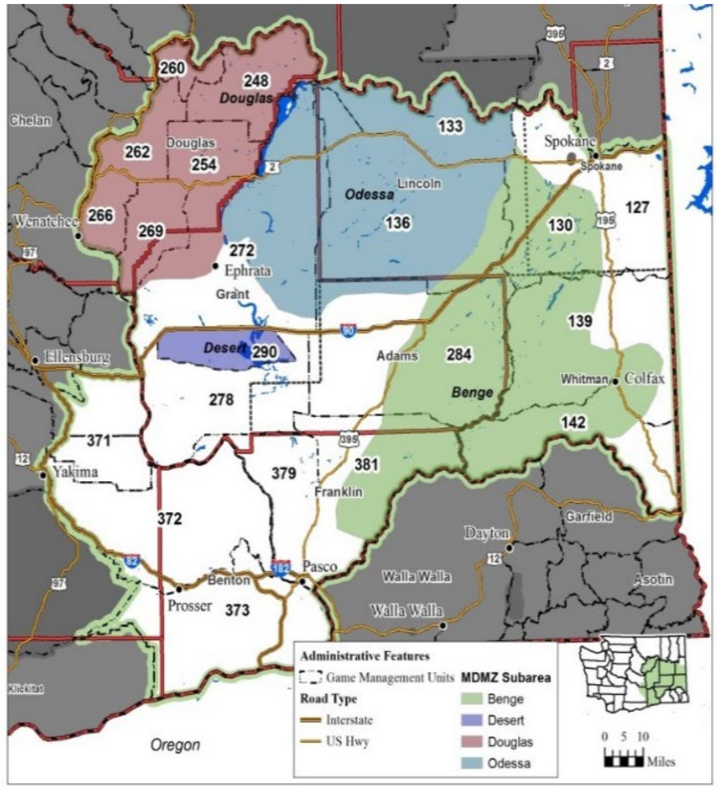

Figure 2. Subherd area boundaries for post-hunt aerial mule deer population surveys in the Columbia Plateau MDMZ.

Odessa Subherd

Odessa Subherd population estimates from aerial sightability surveys conducted from 2012-2014 and 2019 resulted in population estimates ranging from 10,980 to 13,582 deer (Figure 3). Buck-to-doe ratios based on annual ground surveys have been above management objectives every year for the past ten years, except 2016, but most 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 ≥60 fawns per 100 does, except in 2015 and 2021 (Figure 4). The low fawn-to-doe ratio in both of these years was probably due to severe drought reducing fawn survival.

Benge Subherd

Benge Subherd population appears to be relatively stable; estimates from aerial sightability surveys conducted from 2009-2011, 2015, and 2021 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 in 2016 (Figure 6). However, like the Odessa Subherd, the majority of bucks observed were yearlings. The decline in the buck-to-doe ratio estimates observed in 2016 was also 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-year average of 63 fawns per 100 does (range = 48–74; Figure 6). The low points of 2015 and 2021 are likely due to reduced fawn survival caused by severe drought conditions.

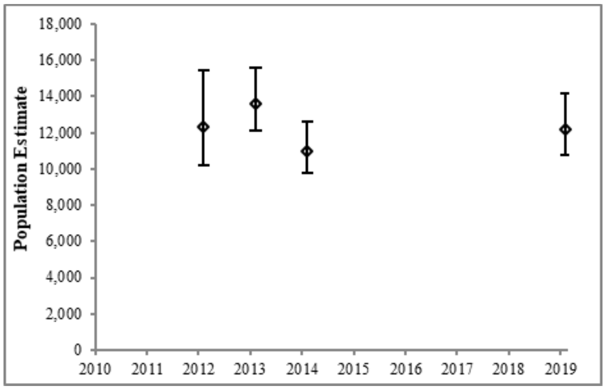

Figure 3. Abundance estimates and 90% confidence intervals from aerial mule deer surveys of the Odessa Subherd in the Columbia Plateau MDMZ, 2010-2019.

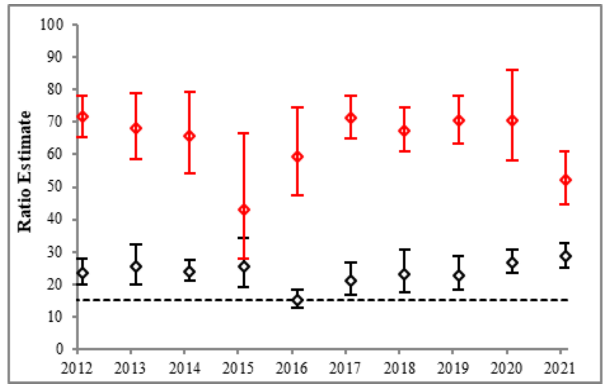

Figure 4. Fawn:doe (red) and buck:doe (black) ratio estimates and 90% confidence intervals from ground-based surveys of the Odessa Subherd in the Columbia Plateau MDMZ, 2012-2021.

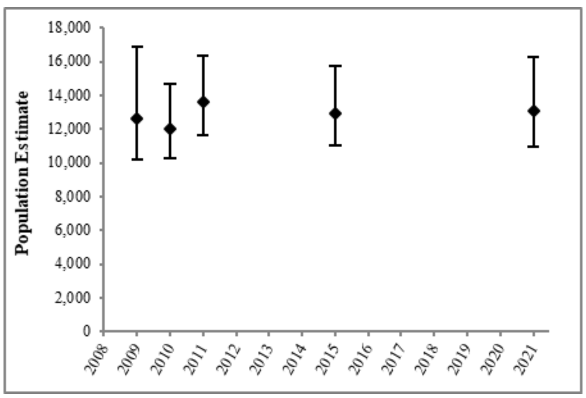

Figure 5. Abundance estimates and 90% confidence intervals from aerial mule deer surveys of the Benge Subherd in the Columbia Plateau MDMZ, 2009-2021.

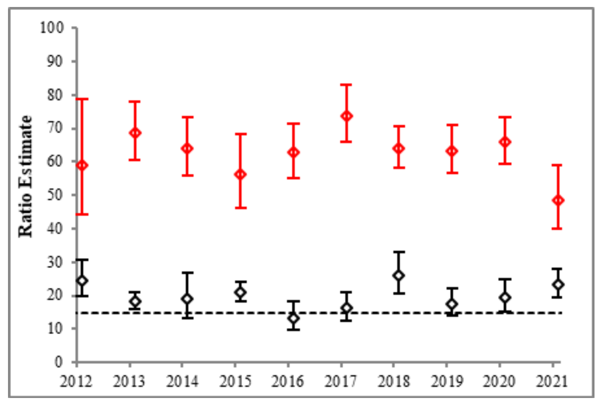

Figure 6. Fawn:doe (red) and buck:doe (black) ratio estimates and 90% confidence intervals from ground-based surveys of the Benge Subherd in the Columbia Plateau MDMZ, 2012-2021.

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 conducted in 2021, and estimates were consistent with previous survey results.

Douglas Subherd

Douglas Subherd's buck-to-doe ratio estimates have been at or above management objectives for over ten years (Figure 10). The five-year average buck:doe ratio from 2017-2020 was 22:100 for the Douglas Subherd. The buck-to-doe ratio derived from 2022 surveys falls right in line with this average at 23:100. Most 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 also been stable for over a decade in the Douglas Subherd (Figure 10). The five-year average fawn:doe ratio from 2017-2020 was 71:100, and the 2021 survey result again closely mirrors this average with a 70:100 fawn:doe ratio.

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). The 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 aerial surveys for abundance estimates planned to occur at 3-5-year intervals, with the next aerial survey of the Douglas Subherd planned for December 2022.

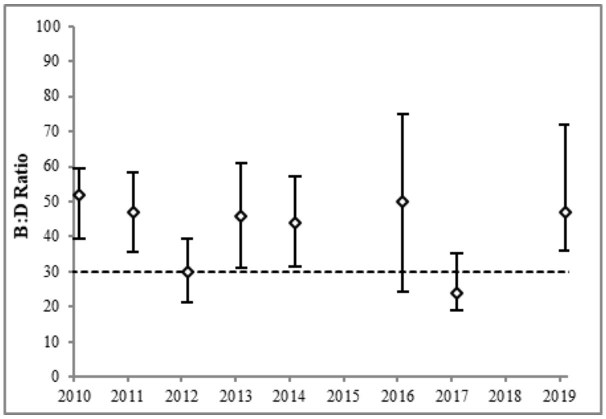

Figure 7. Buck:doe ratio estimates and 90% confidence intervals from aerial mule deer surveys of the Desert Unit in the Columbia Plateau MDMZ, 2010-2019.

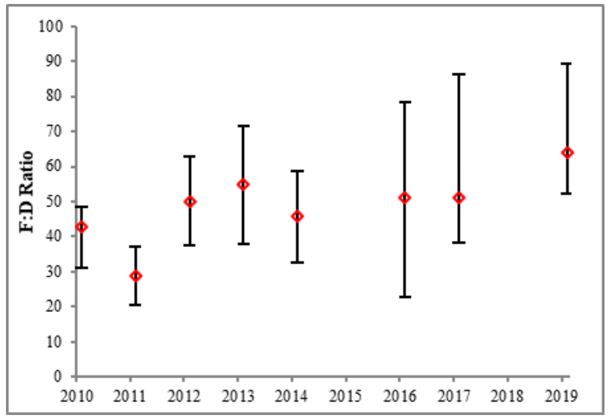

Figure 8. Fawn:doe ratio estimates and 90% confidence intervals from aerial mule deer surveys of the Desert Unit in the Columbia Plateau MDMZ, 2010-2019.

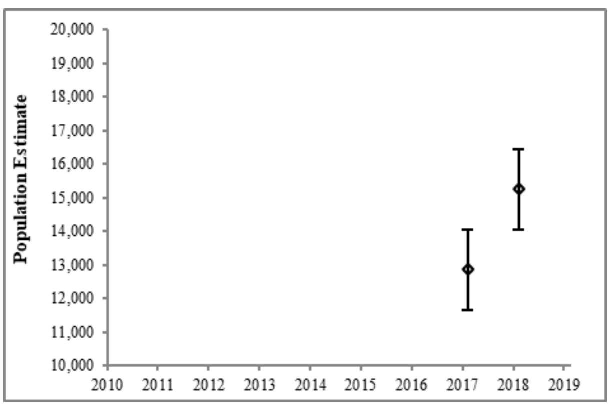

Figure 9. Abundance estimates and 90% confidence intervals from aerial mule deer surveys of the Douglas Subherd in the Columbia Plateau MDMZ, 2010-2019.

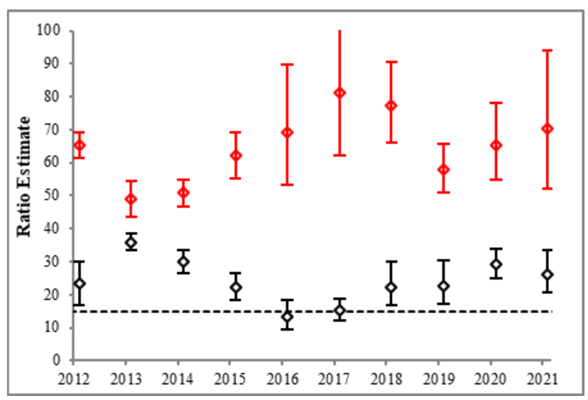

Figure 10. Fawn:doe (red) and buck:doe (black) ratio estimates and 90% confidence intervals from ground-based surveys of the Douglas Subherd in the Columbia Plateau MDMZ, 2012-2021.

Hunting Seasons and Recreational Harvest

More mule deer are harvested in the Columbia Plateau MDMZ than in any other zone, and harvest has been relatively stable outside of the dip in 2016-2018 and the drop in 2021 (Figure 11). The decline in the 2016 harvest was likely due to poor fawn recruitment in 2015 associated with drought conditions. However, there were also fewer hunters, which may have resulted in fewer deer being harvested. The low harvest in 2017 was likely due to the hard winter of 2016/17. The drop in 2021 is likely tied to the severe drought and Epizootic hemorrhagic disease (EHD/BT) outbreak, neither of which is believed to have significantly impacted the adult mule deer population. However, it did severely impact the white-tailed deer population, and the perception that it might have done the same to the mule deer likely kept many hunters home and may have led private landowners (most of this zone is privately owned) to limit access.

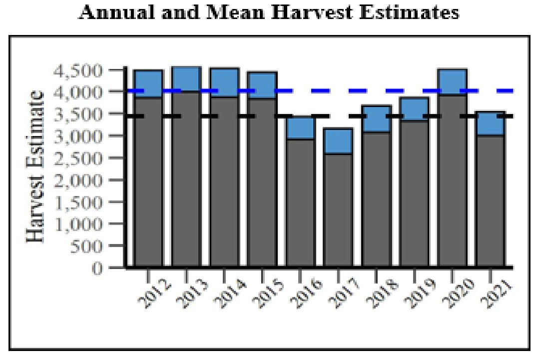

Figure 11. Harvest estimates and 10-yr means (dashed lines) for General State Harvest (gray), General State + Permit State Harvest (blue) in the Columbia Plateau MDMZ, 2012-2021.

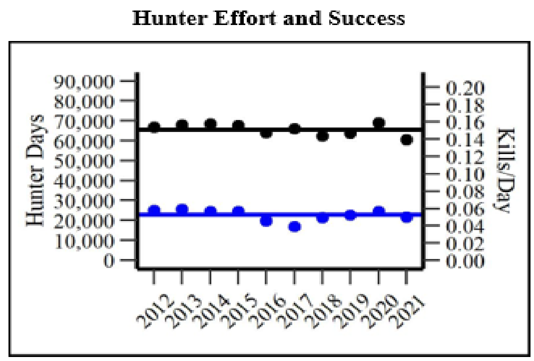

Figure 12. Ten-year mean for hunter days (black) and kills/day (blue) in the Columbia Plateau MDMZ, 2012-2021.

Measures of hunter effort in the zone have generally been stable during the past ten years (Figure 12). Estimates of hunter effort (i.e., hunter days; Figure 12) 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 low.

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 six 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; $\hat{s}$ = .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.

The availability of suitable habitats, disease events, and other factors will influence survival, pregnancy, 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 wildfires have become more frequent and intense in recent years and can often result in a rapid invasion of exotic plant species such as cheatgrass, which perpetuates more fire. In 2020, two of the largest wildfires in the state's history occurred in this management zone: the Pearl Hill (223,730-ac) and Whitney Rd (127,430-ac) fires. Restoration of native vegetation requires an 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 the 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 13). 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 staff works 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.

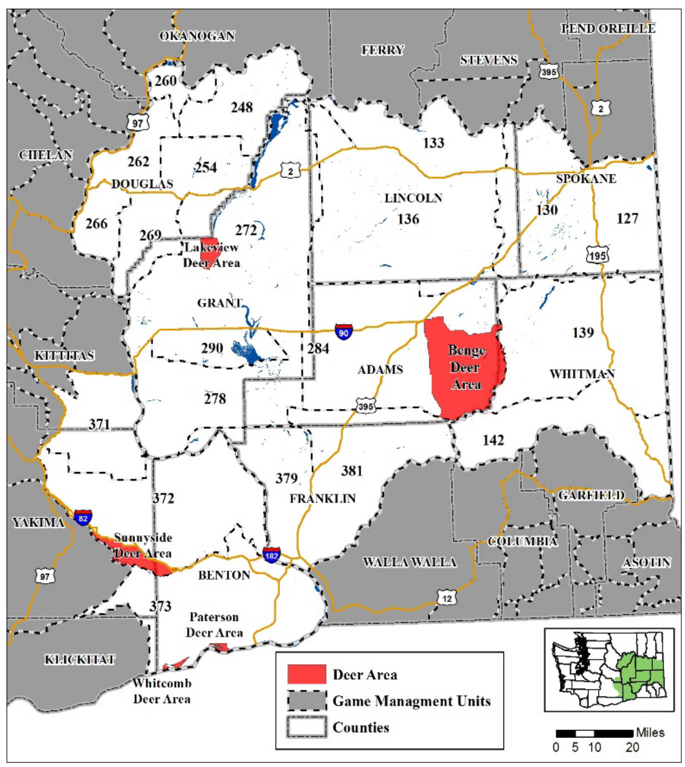

Figure 13. Deer Areas within the Columbia Plateau MDMZ, 2019.

Management Concerns

As previously discussed, habitat loss and habitat degradation are management concerns in this area. While the expansion of agricultural crops is currently low relative to historical rates 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 hay harvest of CRP lands. Those changes 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, the overall size of the area burned, the season of burn, and the intensity of the burn.

Short-term impacts may include reduced habitat suitability, which is particularly damaging during the summer fawning season and 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. Areas with older shrub-steppe habitats and good species diversity are limited and declining annually due to fires and housing development. High-value shrub-steppe habitats can take over 50 years to develop. Combating encroachment by invasive species is a difficult and expensive battle once intact habitat burns.

A relatively new threat to habitat for mule deer in this zone is solar power generation. These installations range from just a few hundred acres to upwards of 10,000 acres. They are often sited in rangelands (shrub-steppe habitat), and adjacent dryland agriculture. The majority of vegetation is either permanently removed, especially larger shrubs, or regularly mowed to a short height in order to keep it from interfering with solar exposure of the panels. Additionally, the perimeter fencing installed at these sites tend to be wildlife unfriendly (e.g., six-foot-high chain link fence) effectively keeping mule deer out of the site that, at large installations, can impact broader movement across the landscape.

Management Conclusions

Mule deer populations in the Columbia Plateau MDMZ are currently at management objectives based on buck-to-doe ratio estimates. Demographic and survey data indicate stable populations between years. Zone-wide harvest appeared to be recovering from the decline observed in 2016 and 2017 but dropped again in 2021 likely tied to the severe drought that year. Though there was no decline observed in the adult population during flights in the Benge Subherd in 2021, there was a decline in fawns. This decline was further supported by reduced fawn-to-doe ratios observed in ground surveys in the Benge and Odessa subherds but not in the Douglas Subherd. The decline in fawns will likely lead to a lower-than-average harvest in the coming year or two, as the harvest is highly dependent on yearling buck recruitment. But assuming a return to more normal fawn survival in the coming years, this should be a relatively short downturn.

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East Columbia Gorge Mule Deer Management Zone

CARLY WICKHEM, Wildlife Biologist
STEFANIE BERGH, Wildlife Biologist

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).

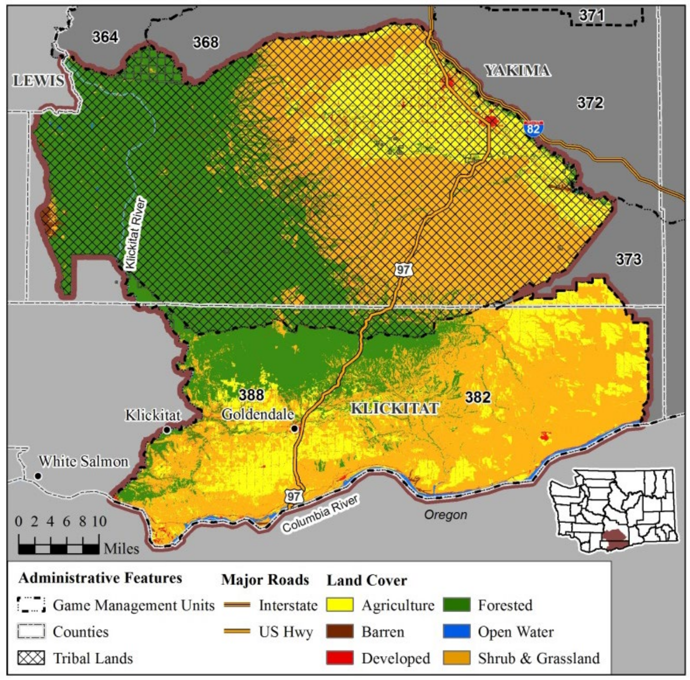

Figure 1. GMUs and generalized land cover types within the East Columbia Gorge MDMZ.

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 from January through April throughout the low-elevation winter ranges. Post-hunt aerial surveys conducted in December of 2021 resulted in a buck:doe estimate of 18:100 (95% CI = 11–25, n = 1,866), which is within the management objective. The post-hunt fawn:doe estimate for 2021 was 56:100 (95% CI = 45–67, n = 1,886), a decrease from the previous three surveys that observed 64 fawns:100 does in 2017, 62 fawns:100 does in 2018, and 58 fawns:100 does in 2019. Washington Department of Fish & Wildlife (WDFW) biologists did not conduct population surveys in 2020 because of COVID-19 restrictions.

Hunting Seasons and Recreational Harvest

After three years of decline, harvest in the East Columbia Gorge MDMZ increased in 2019 and 2020. However, after meeting the 10-year average in 2020, the 2021 estimate declined again. Estimates from 2016-2018 indicated a decline in harvest (Figure 2) that likely reflected, in part, decreased hunter participation and effort (Figure 3), fewer antlerless permits offered, and population declines within the zone. After the declines in 2016 and 2017, estimates of harvests/day were up in 2018, 2019, and 2020 (with 2020 rates surpassing the 10-year average) before returning to the average in 2021 (Figure 3). The 2020 increase in harvest was potentially bolstered by a surge in hunter participation and effort during the COVID-19 pandemic, and the decline in harvest in 2021 may be due to hunter participation adjusting back to more normal levels.

Survival and Mortality

There are no current data on the 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 declines in mule deer numbers. Common predator species include cougar, bobcat, black bear, and coyote.

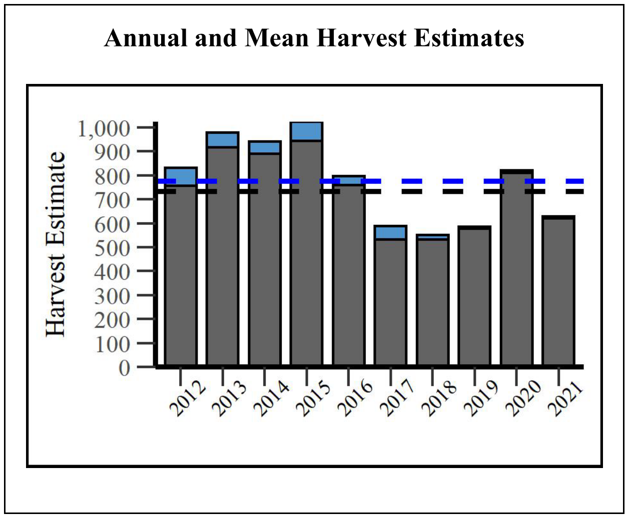

Figure 2. Harvest estimates and 10-yr mean (dashed lines) for General State Harvest (gray), General State + Permit State Harvest (blue) in the East Columbia Gorge MDMZ, 2012-2021.

The winter of 2016-17 was very severe, with persistent snow down to Columbia River level (lowest elevations of the MDMZ) from December through February, making forage unavailable in key wintering habitats. As a result, population and harvest estimates dropped in 2017 and 2018. The four following winters were mild to average, except for the late winters/early springs of 2019 and 2022, which had several large snowfall events and persistent cold temperatures into April. During spring 2022 productivity surveys, 273 deer were classified, which resulted in a fawn:adult estimate of 57:100, which is above the 10-year average of 53:100. The annual post-hunt aerial surveys scheduled for December 2022 will continue to monitor the population as it hopefully recovers from the severe winter of 2016-17.

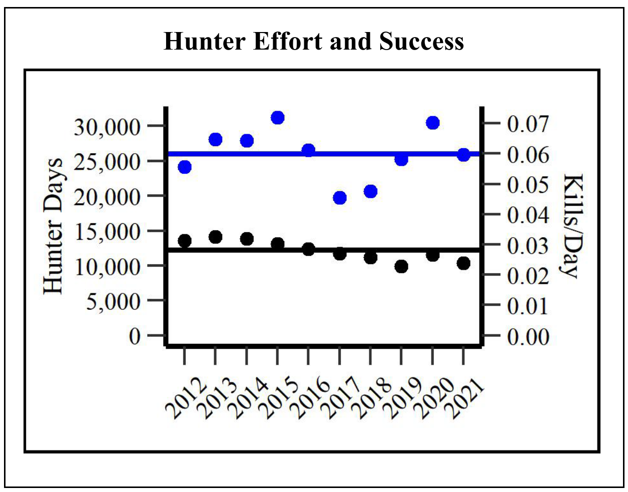

Figure 3. Ten-year mean for hunter days (black) and harvests/day (blue) in the East Columbia Gorge MDMZ, 2012-2021.

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 of this disease. AHD was again confirmed near Goldendale in July 2022 in at least two deer, though many others have been reported exhibiting AHD symptoms. As of the writing of this document, the extent and severity of the 2022 outbreak are unknown. 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.

Habitat

The East Columbia Gorge MDMZ has experienced extensive alternative energy development and agricultural land conversion in recent years. Electricity generated by wind power 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 habitats (Hebblewhite, 2008; Fargione et al., 2012), especially in the winter range of mule deer in the East Columbia Gorge MDMZ. In addition, construction on the first industrial-scale solar farm in this MDMZ was completed in 2022, and several other 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 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. In 2021-2022, two DPCAs, one kill permit, and two damage prevention permits were issued relating to mule deer in the East Columbia Gorge MDMZ. All were issued to address damage to hay and grains. As a result, four adult female mule deer were harvested from GMU 388. 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.

Research

In January 2021, a 4-year study was initiated to investigate mule deer movement and migration patterns in the East Columbia Gorge MDMZ. Eighty-one adult female mule deer were captured and fitted with GPS collars. The primary focus of this study is to identify mule deer migration routes and winter ranges within the MDMZ, with the goal of preserving and enhancing habitat in these areas. When possible, biologists are also attempting to determine the cause of death when a collared animal dies and will calculate vital rates like annual survival. Biologists will redeploy collars each winter with a goal of maintaining approximately 80 collars in the MDMZ throughout the 4-year period. Preliminary results have shown that some of the deer are migratory while others are not. Attempting to determine the cause of death has proven difficult due to how quickly scavengers find the carcasses. Nearly half of the mortalities have an unknown cause of death due to a lack of carcass or evidence. Most mortalities with an assigned cause of death are from predation, mainly by cougars.

Management Concerns

Deer hair loss syndrome was observed in Klickitat County for the first time in 2000 and was first documented in GMU 382 in the spring of 2006. None of the deer observed during road-based surveys conducted in March 2022 in and around the Klickitat Wildlife Area had noticeable signs of the syndrome, which is the first time since 2006 that no hair loss was recorded during this survey. However, throughout the spring, several incidental deer sightings confirmed that hair loss is still present within the population. Late 1990s declines in hunter harvest, increases in buck mortality rates, and reduced fawn recruitment all roughly coincide with the onset of the hair loss syndrome. WDFW 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, has 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 thought to be migratory and spend the winter in lower elevations, typically preferring habitats 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

Since December 2019, mule deer populations in the East Columbia Gorge MDMZ have been within the buck:doe management objectives. 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 antlerless special permits, reduced the number of remaining antlerless permits, and reduced the number of quality and buck special permits to allow the population to recover. Before the fall 2021 hunting season, managers also removed the antlerless opportunity from archery general seasons in GMUs 382 and 388. The 2020 harvest estimates showed an increase from recent years, but estimates declined again in 2021, so managers will plan to keep the current special permit and general season changes until the deer numbers improve. Annual survey efforts and the data collected from hunter reporting will allow managers to continue monitoring the population and determine future management needs.

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East Slope Cascades Mule Deer Management Zone

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JEFFREY A. BERNATOWICZ, Wildlife Biologist

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).

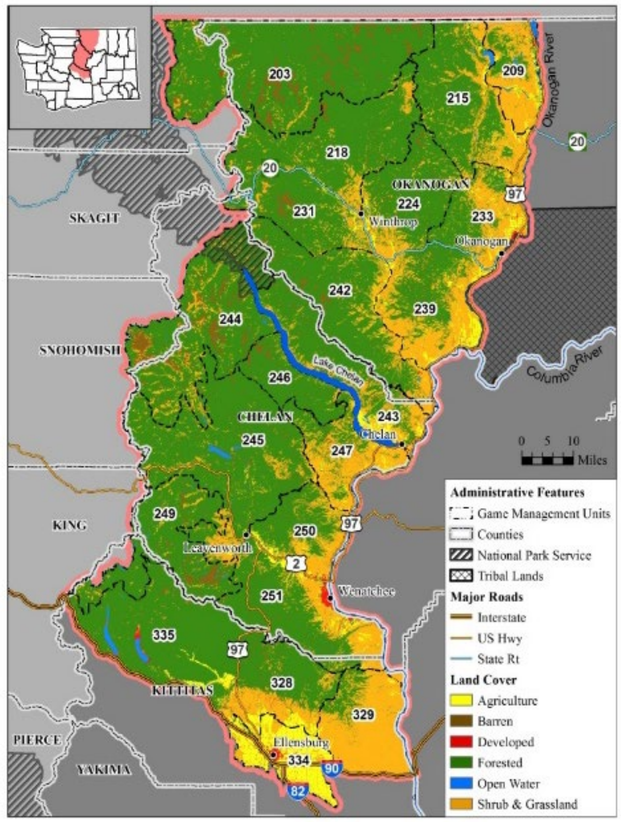

Figure 1. GMUs and generalized land cover types within the East Slope Cascades MDMZ.

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. The generally conservative antlerless mule deer harvest in this zone typically has minimal effect on the population and is designed to maintain population stability while still providing some recreational opportunities. Infrequently, increased harvest of antlerless mule deer is used to limit herd growth, reduce deer numbers in damage areas, or respond to dramatic changes in carrying capacity such as those associated with large wildfires. Conversely, antlerless harvest is occasionally reduced to minimum levels or suspended to promote herd growth following periods of above-average mortality created by a stochastic event such as harsh winters or disease outbreaks.

Population Surveys

Mule deer are present throughout the East Slope Cascades MDMZ, with the highest densities observed from January through March on traditional winter ranges of low elevation. Populations within the zone are comprised of four 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 that approximately 47,000 mule deer resided within the East Slope Cascades MDMZ (WDFW, 2013).

Methow and Okanogan Subherds

Over 2,300 mule deer were classified during the post-hunt aerial surveys for the Western two-thirds of District 6 (Okanogan County) in 2021. This effort produced observed buck:doe and fawn:doe ratios of 20:100 and 76:100, respectively (Figure 2a). Both ratios are close to the long-term averages for those parameters, and the fawn:doe figure is the highest recorded since the 2014-15 landscape-level fires in the ungulate winter range. The 2022 spring ground surveys tallied 1550 animals yielding a fawn:adult ratio (Figure 2b) of 29:100, a little below the 10-yr average of 33.

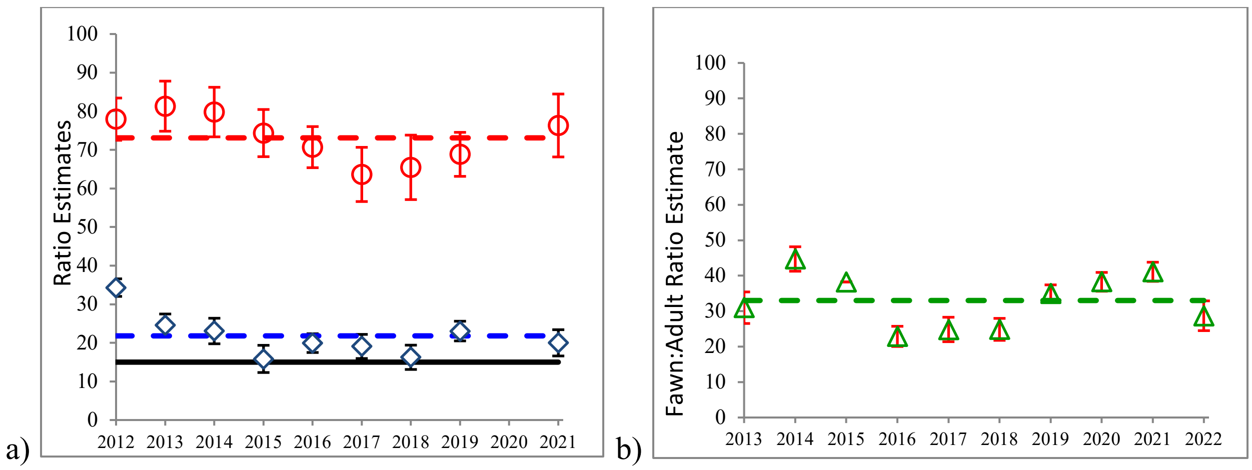

Figure 2. (a) Post-hunt buck:doe ratio estimates (black) and fawn:doe ratio estimates (red) with 10-year means 2012-2021* (dashed lines), and minimum ratio management objective (solid black line); and (b) spring fawn:adult ratio estimates with 10-year mean 2013-2022 (dashed line); for mule deer in the northern subherds of the East Slope Cascades MDMZ. ****No survey data in 2021 due to COVID restrictions*.

Buck:doe ratios for the northern subherd have consistently met or exceeded the management objective of 15:100 does (Figures 2a). A combination of rugged topography and limited road access in many GMUs facilitates higher buck escapement, which results in a higher proportion of older age class bucks in the population. Fawn recruitment varies from year to year, largely fluctuating in response to winter conditions. A high-quality summer range has traditionally led to high fawn production. Late fall fawn:doe ratios fell in the wake of intense fire and drought in the middle of the last decade but have rebounded to pre-fire levels.

Chelan Subherd

After being unable to fly this portion of the East Slope Cascades MDMZ for a couple of years due to COVID-19 safety concerns and persistent inclement weather, biologists successfully completed a post-hunt aerial survey of the Chelan subherd in December 2021. Nearly 1,800 deer were classified during this survey, resulting in an estimated buck:doe ratio of 24:100 and an estimated fawn:doe ratio of 76:100.

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, and the effects of the 2016-17 winter, appears 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), 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 estimates of 83.4 (90% CI = 63.4 – 103.4; Figure 3a). The results of the 2021 survey suggest that herd composition has remained stable over the past few years, with buck:doe and fawn:doe estimates comparable to those from 2018.

To better understand fawns' recruitment into the population, biologists will also begin conducting early spring surveys. differentiate fawns from adults in spring is challenging, however, so these surveys would likely need to be performed on the ground. This means that the success of spring survey efforts will depend on accessing enough winter range by vehicle or foot to survey deer in sufficient numbers. The next post-hunt aerial survey of the Chelan subherd is planned for December 2023, with a spring survey following in March or April 2024.

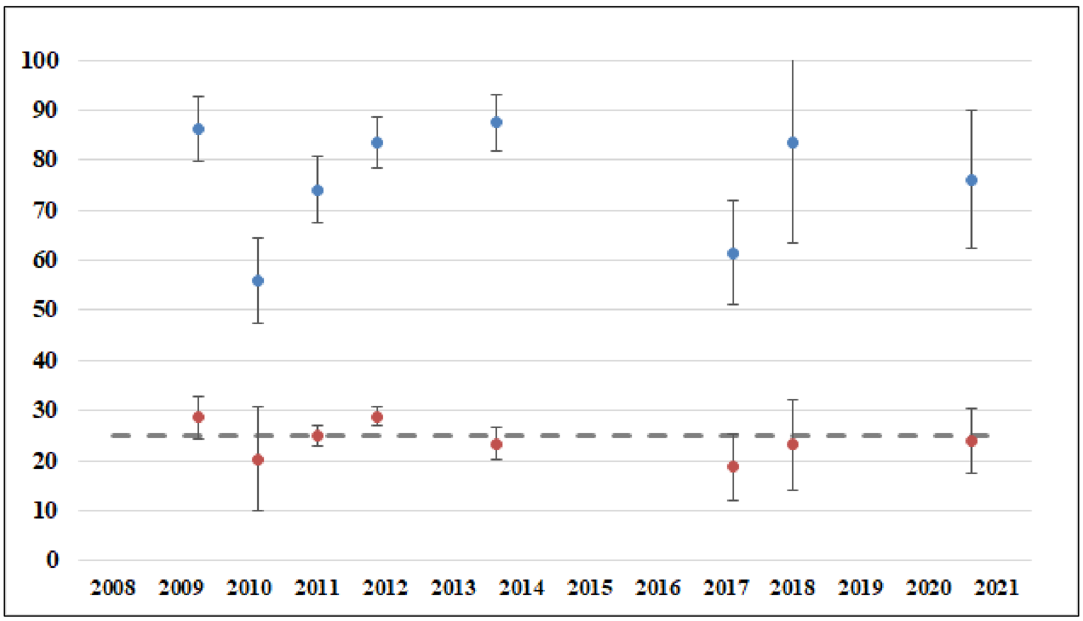

Figure 3. Estimate of post-hunt buck:doe (red) and fawn:doe (blue) ratios with 90% confidence intervals for the Chelan subherd in the East Slope Cascades MDMZ between 2008 and 2021. Dashed line represents buck:doe management objective.

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

Overall, mule deer harvest has been relatively stable in the East Slope Cascades MDMZ for at least a decade. An exception occurred in 2015 when a later than average season-ending date and significant early high-country snow combined to accelerate migration behavior and produce a harvest spike. In 2017-18, diminished winter shrub forage availability following the landscape-level fires in the northern two-thirds of the zone likely contributed to the observed dips in harvest.

Since 2015, harvest estimates have fluctuated more modestly. They have likely more closely tracked actual changes in the deer population following the big fire years in the middle part of the past decade (Figure 4). For the last three seasons, harvest, participation, and success have all been near the 10-year average, suggesting that deer populations in the East Slope Cascades MDMZ remain stable or continue to increase gradually.

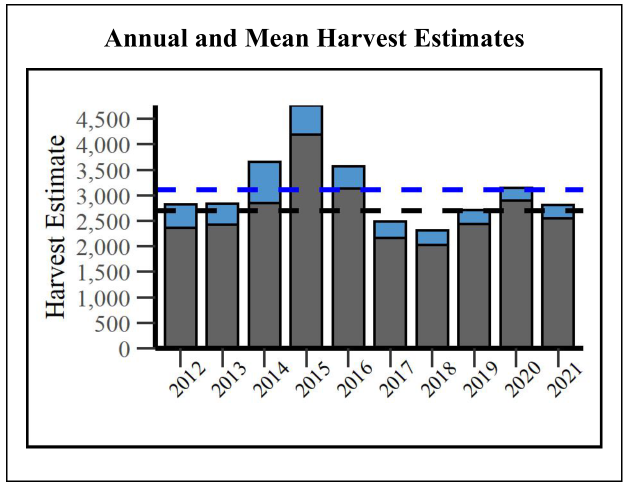

Figure 4. Harvest estimates and 10-yr mean (dashed lines) for (a) General State Harvest (gray) and General + Permit State Harvest (blue) in the East Slope Cascades MDMZ, 2012-2021.

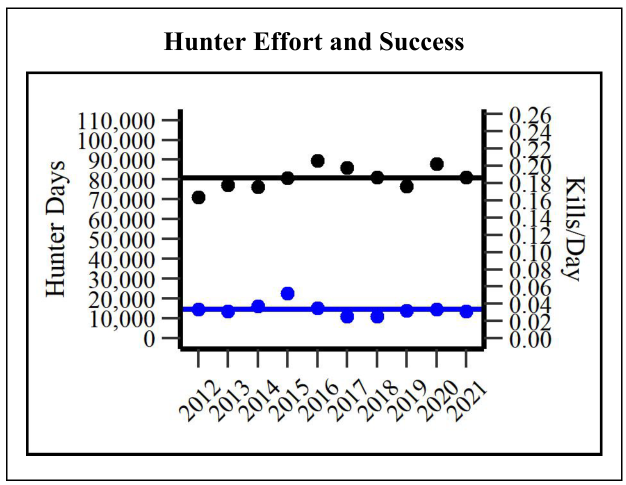

Figure 5. General season estimates and 10-yr mean for hunter days (black) and kills/day (blue); in the East Slope Cascades MDMZ, 2012-2021.

Survival and Mortality

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

Habitat

This zone's productive, high mountain habitats 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, 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, 30+ 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 elevations and the 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 help reduce deer damage complaints.

Damage Prevention Cooperative Agreements (DPCA) and Kill permits are also conservatively issued to reduce deer damage throughout the Zone. In 2021, WDFW Conflict Specialists issued only 18 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. State Highways 97 and 97A are the major contributors to deer-vehicle collisions in the central portion of the zone.

Research

A large-scale predator-prey study with a mule deer component began in the northern portion of the zone in January 2017. This partnership effort between WDFW and the University of Washington utilized 75-100 radio-collared mule deer for 4+ years and collected data on cause-specific sources of mortality for adult females. The radio-marked animals are also being used to collect migration data similar to that mentioned below. This project is in the data analysis and write-up phase, and published results should be available within the next year or two.

In 2019, funding was provided by the US Department of Interior for a four-year study to determine migratory routes, stopover areas, and seasonal ranges of mule deer in the East Slope Cascades MDMZ. In January 2020, 98 adult female mule deer were captured across Chelan (n = 40) and Kittitas (n = 58) counties and fitted with global positioning system (GPS) collars expected to last four years. In January 2021, biologists redeployed collars retrieved from mortalities that occurred over the previous year to maintain a sample size of approximately 100 animals. This annual process will be repeated for the duration of the study. Initial analyses of GPS collar data to determine movement strategies during the first year have revealed that the Chelan subherd is 68% migratory and 32% resident, whereas the inverse relationship is present in the Kittitas subherd with 30% migratory and 70% resident.

Adult survival proportions during the first year were 83% for Chelan and 69% for Kittitas. Although cause-specific mortality is not a focus of this study, biologists investigated mortalities to determine the proximate cause if sufficient evidence was present. In Chelan, all mortalities were classified as "unknown" causes as snow conditions or private land access typically precluded biologists from reaching carcasses in time to determine the cause of death. In Kittitas, 35% of mortalities were attributed to cougars, 12% were vehicle collisions, and 47% were classified as "unknown" causes. Analyses of movement behavior and survival are ongoing, as is the identification of important migration routes and stopover points for mule deer in the East Slope Cascades MDMZ.

Management Concerns

Extensive loss of winter range shrub forage due to wildfire and development is currently the major management concern in the northern three-fourths of the zone. 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 effects are most prominent where conditions limit restoration success, such as on steep aspects with shallow dry soil. Mule deer access to winter forage is also threatened by ongoing human population expansion in areas such as Wenatchee and Chelan. In these places and others throughout the East Slope Cascades MDMZ, new housing developments continue to encroach upon the already limited winter range available to deer in the foothills and lowlands.

In the northern portion of the zone, recent composition counts have documented rebounding spring fawn:adult ratios over the last four years. Drought conditions also eased during this time likely improving the quality of summer range, an important factor in productivity and overall deer health.

Management Conclusions

As of December 2019, mule deer populations in the East Slope Cascades MDMZ were 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 the objective in the south, suggesting current buck harvest strategies are generally sustainable. Past surveys indicated a decline in the overall population in the zone immediately following the 2014-15 fires, but more recent demographic data suggests the population is now growing slowly. This current population trend is anticipated to continue to the extent that: 1) winter shrub forage continues to recover, 2) winter conditions are moderate, and 3) extreme summer drought is absent.

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Naches Mule Deer Management Zone

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Introduction

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

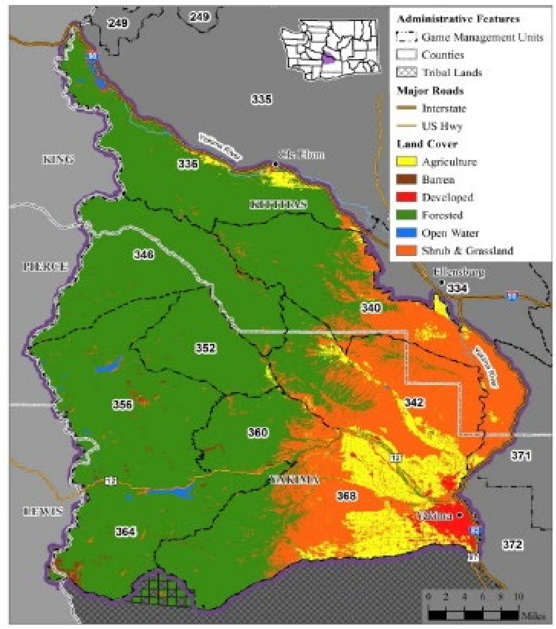

Figure 1. GMUs and generalized land cover types within the Naches MDMZ.

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 in March and April on low-elevation winter ranges as the forage 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 site 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). Since 2017, only the northern portion of the zone has been flown. The population there decreased by about 43% from 2015 to 2017. The Muckleshoot Indian Tribe (MIT) flew surveys in the northern zone in 2018-2022, intending to estimate population size, and the population appears to be rebounding since 2018.

Ground surveys have been conducted periodically since the early 1990s 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 ten years has been variable annually (Figure 2) but largely reflects population survey results. Drought and severe winters decreased the population from 2015-2017; it is now rebounding but below historic and 10-year averages. Neither Native American tribe that hunts the Naches MDZ reports official harvest data. The Yakama Nation season for bucks is year-round, with antlerless take allowed from September through December. The Muckleshoot Indian Tribe restricts harvest to buck-only during the fall.

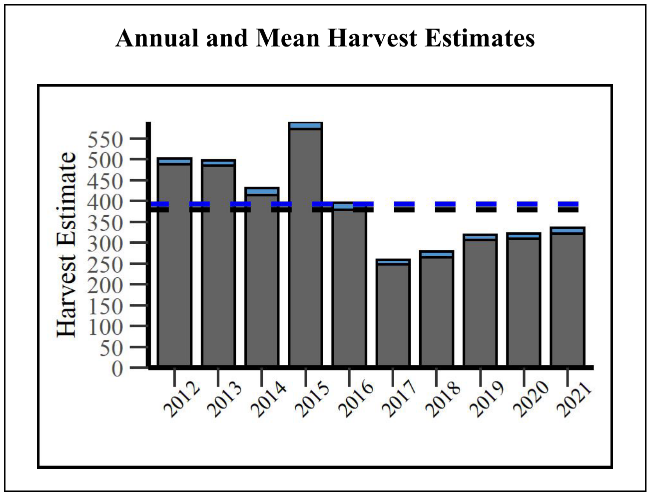

Figure 2. Harvest estimates and 10-yr means (dashed lines) for General State Harvest (gray) and General + Permit State Harvest (blue) in the Naches MDMZ, 2012-2021.

Survival and Mortality

The Muckleshoot Indian Tribe initiated telemetry studies beginning in 2012. These ongoing studies will provide managers with zone-specific survival and movement information. The research design goal is to have 100 adult does radio-collared each winter. Estimates of annual survival rates for adult female mule deer averaged 80% and ranged from 67% in years with more severe drought/winter weather to 90% 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).

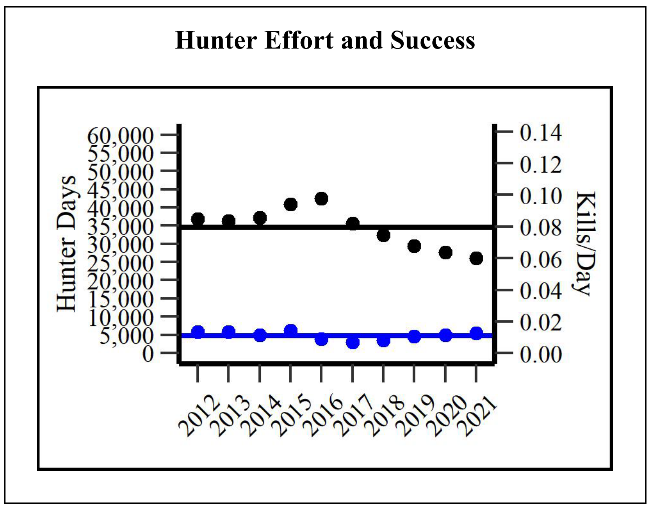

Figure 3. General season estimates and 10-yr mean for hunter days (black) and harvest/day (blue) in the Naches MDMZ, 2012-2021.

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 have been 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 of having hair-loss syndrome and subsequent winter mortality (Bernatowicz et al., 2011). Another suspected, but unconfirmed, pathogen may have been adenovirus hemorrhagic disease. The population has not rebounded to historic levels noted before 2004.

Habitat

Deer radio-collared 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 and 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 and burning in GMU 352 appeared to have converted many areas to park-like ponderosa pine/grass. Radio-marked deer made limited use of those areas, which have now burned in a major fire in 2021.

Human-Wildlife Interaction

Deer conflicts with agriculture in the Naches MDMZ are typically minimal. In 2021-2022, there were three does reported taken on landowner kill permits.

Management Concerns

The largest concern in the Naches MDMZ is that deer density remains well below historical levels. Surveys and harvests indicate the population is at one of the lowest levels in modern history. Recent summer droughts were followed by moderate winters and significant population declines. 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 the habitat is also a factor. Cougar predation is not likely the cause of the deer decline but may affect the pace and scale of population recovery.

Wildfires, thinning, and controlled burns are increasing and may increase browse production in more moist forest zones. In the shrub-steppe, fires have converted the range to grass. Restoration in arid environments is very challenging, especially in shallow soil areas. Restoration often involves native plants only, which may limit potential benefits to deer. In mild winters following summers with adequate moisture, the population will increase slowly, but it will 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 soon 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.

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Northern Rocky Mountains Mule Deer Management Zone

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MIKE ATAMIAN, Wildlife Biologist
CARRIE LOWE, Wildlife Biologist

Introduction

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

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.

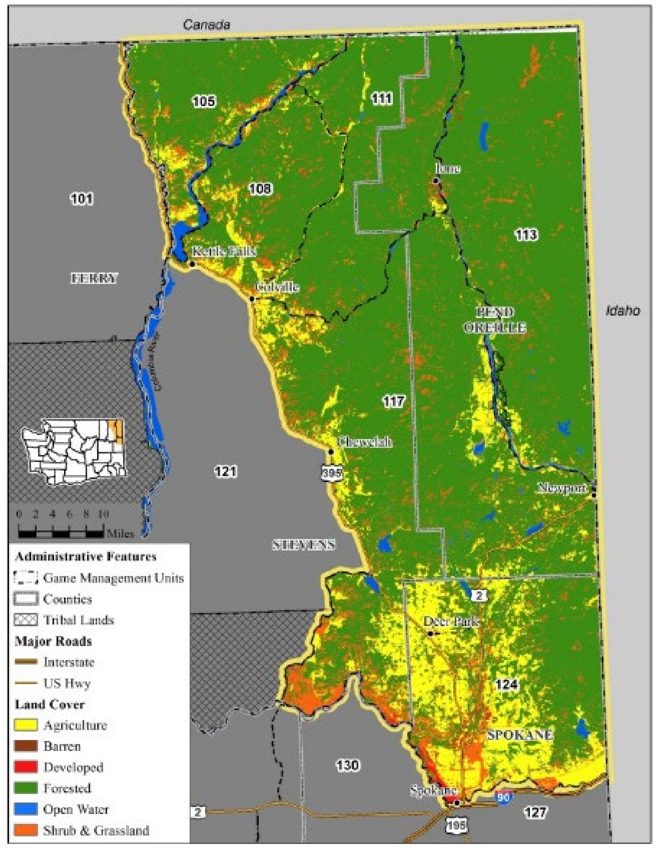

Figure 1. GMUs and generalized land cover types within the Northern Rocky Mountains MDMZ.

Hunting Seasons and Recreational Harvest

Harvest estimates fluctuate year to year, reflective of the lack of availability of preferred habitat for mule deer in this zone (Figure 2). Estimates of hunter effort (i.e., hunter days; Figure 3) and harvest rate (i.e., kills/day; Figure 3) 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 number of days spent hunting only mule deer is substantially lower, and harvest rates are higher than indicated.

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, gray wolves, bobcats, and coyotes occur within this MDMZ, and predation's effects on this mule deer population are unknown.

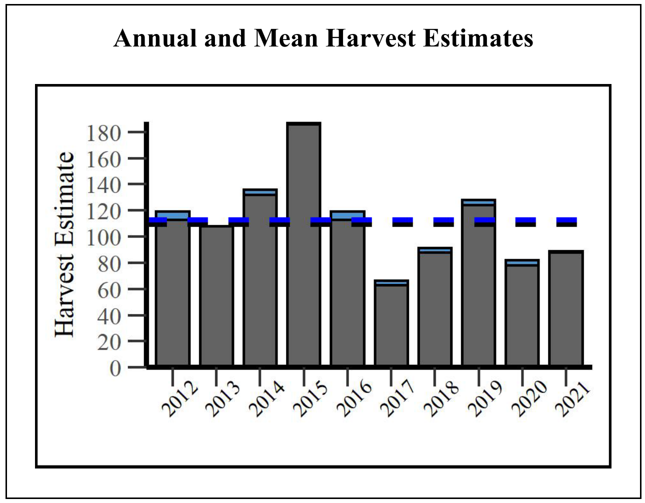

Figure 2. Harvest estimates and 10-yr means (dashed lines) for General State Harvest (gray) and General + Permit State Harvest (blue) in the Northern Rocky Mountains MDMZ, 2012-2021.

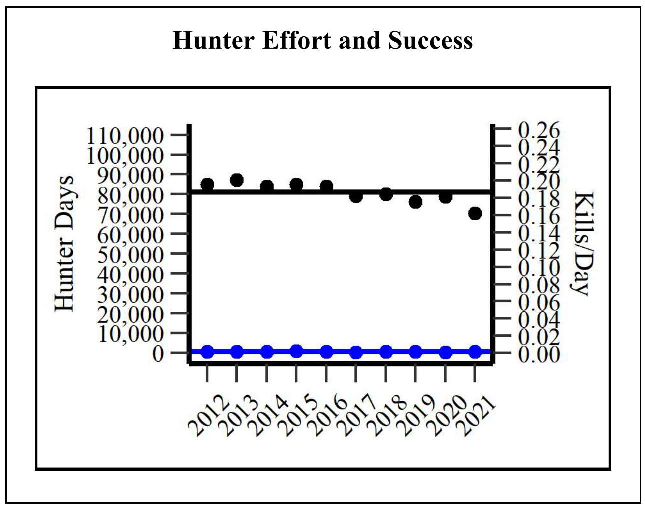

Figure 3. General season estimates and 10-yr mean for hunter days (black) and kills/day (blue); in the Northern Rocky Mountains MDMZ, 2012-2021.

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, and 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-round 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 GMU 124, where residential development along the Spokane River and tributaries is resulting in the loss of traditional habitat. Mule deer, however, are 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, no conflicts have been reported specific to mule deer outside the Spokane area. All Damage Prevention Cooperative Agreements in this zone have been specific to conflicts with white-tailed deer in low-elevation farmlands. Within the Spokane area, conflicts with mule deer have typically involved damage to landscaping and human safety issues, predominantly vehicle-deer collisions along Hwy 291 and Northwest Blvd.

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 at risk based on hunter-harvest metrics. The estimated harvest for 2021 was below the 10-year average but slightly higher than the 2020 estimate.

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

Okanogan Highlands Mule Deer Management Zone

ANNEMARIE PRINCE, Wildlife Biologist
SCOTT FITKIN, Wildlife Biologist

Introduction

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

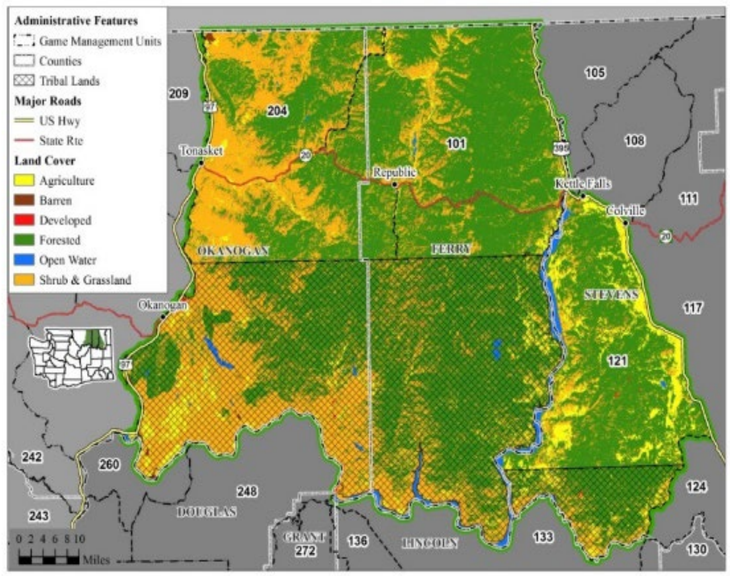

Figure 1. GMUs and generalized land cover types within the Okanogan Highlands MDMZ.

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 Okanogan Highlands MDMZ but 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

Annual harvest for the past ten years has fluctuated modestly. Harvest for the past three years has been relatively stable and slightly below the 10-year average (Figure 2). Hunter days have fluctuated in recent years, and could be due to shortened season length, and kills/day have remained stable (Figure 3).

Survival and Mortality

A study involving adult female mule deer in the zone, conducted between 2000 and 2007, indicated survival ($\hat{s}$ = 0.89, 95% CI = 0.87 – 0.91), pregnancy rates ($\hat{p}$ = 0.93, 90%CI = 0.81 – 1.00), and fetal rates ($\hat{f}$ = 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). A study by Delinger et al. (2018) estimated white-tail and mule deer combined annual survival to be 0.69± 0.04 between 2013 and 2016 within the Okanogan Highlands Mule Deer Management Zone. Predators in the Okanogan Highlands MDMZ include black bears, bobcats, coyotes, cougars, golden eagles, and gray wolves.

Habitat

Habitat within the Okanogan Highlands MDMZ is predominantly conifer forest, contributing approximately 61% of the total land cover within the zone. Shrublands, upland grass and herbaceous, and 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).

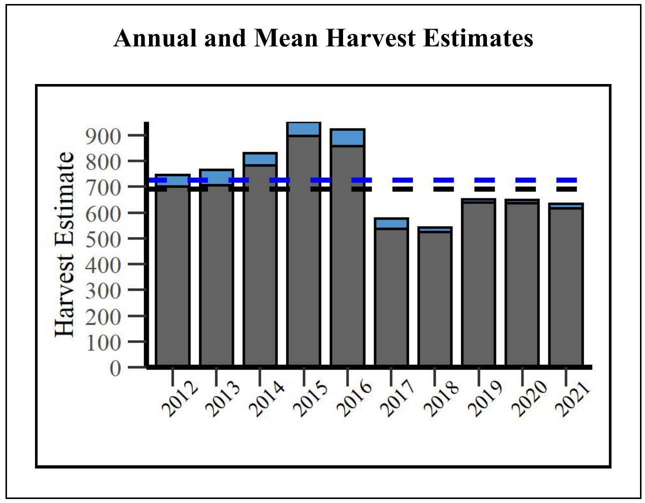

Figure 2. Harvest estimates and 10-yr means (dashed lines) for General State Harvest (gray) and General + Permit State Harvest (blue) in the Okanogan Highlands MDMZ, 2012-2021.

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. Wildfire also alters habitat throughout this zone. Large landscape-scale wildfires are becoming more frequent within this zone. Wildfires can create an immediate loss of habitat but typically improve forage quality in the years following. Loss of forage on the winter range and reduced concealment cover take longer to recover after wildfires. In 2021, approximately 70,000 acres burned from wildfires within this zone.

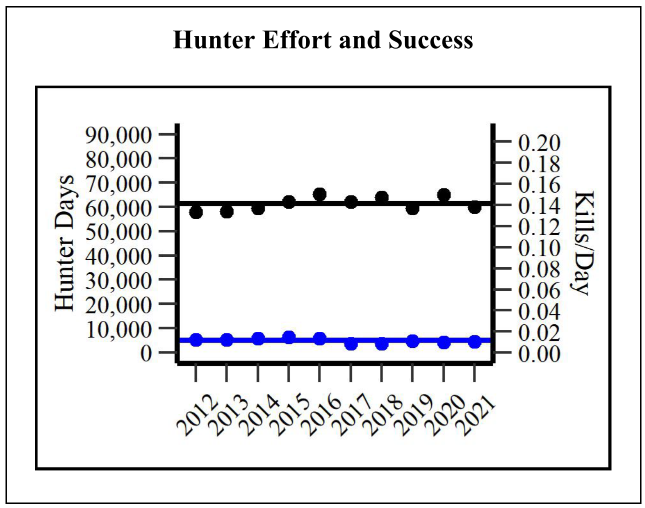

Figure 3. General season estimates and 10-yr mean for hunter days (black) and kills/day (blue); in the Okanogan Highlands MDMZ, 2012-2021.

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 conservatively issued to reduce deer damage throughout the Zone. In 2021, WDFW Conflict Specialists issued 16 damage prevention permits and 18 kill permits to address deer damage throughout the entire Okanogan Highlands MDMZ. These permits were for the harvest of either a white-tailed deer or mule deer.

The town of Republic has a resident, in-town mule deer population that causes property damage and occasionally poses a safety threat. Historically, the town of Republic was issued kill permits annually, so the local police department could address acute deer issues. During 2021, ten permits were issued in case issues arose.

Significant roadkill occurs in the western edge of this zone along a 12.5-mile segment of State Highway 97 between the towns of Riverside and Tonasket, Washington. The Okanogan Trails Mule Deer Foundation Chapter, Conservation Northwest, the Colville Confederated Tribes, the Washington Department of Fish and Wildlife and other local, state and national partners are working with the Washington Department of Transportation to install fencing and underpasses along this segment of State Highway 97 to reduce roadkill and provide safer passage. In 2020, one mile of deer fencing was installed on either side of State Highway 97, running south of the Janis Bridge (with associated gates and cattle guards at access roads), and the Janis Bridge was renovated to serve as a wildlife undercrossing.

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 the over-winter survival of mule deer in this zone, generally affecting fawns more so than adults. In addition, summer heat and drought are becoming more frequent, which can foster conditions for severe outbreaks of hemorrhagic disease, reduce available forage deer need to accrue adequate fat stores for winter, and reduce fawn recruitment. The influence of these factors can complicate how best to balance deer hunting opportunities with herd sustainability.

Management Conclusions

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

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Blue Mountains White-tailed Deer Management Zone

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PAUL WIK, Wildlife Biologist

Introduction

The Blue Mountains White-tailed Deer Management Zone (WDMZ) is in southeast Washington and consists of 11 GMUs (154, 157, 162, 163, 166, 169, 172, 175, 178, 181, and 186; Figure 1). GMU 157 is closed to all entry except by permit, and no white-tailed deer hunting is currently permitted. GMUs 145 and 149 are included in the Palouse WDMZ.

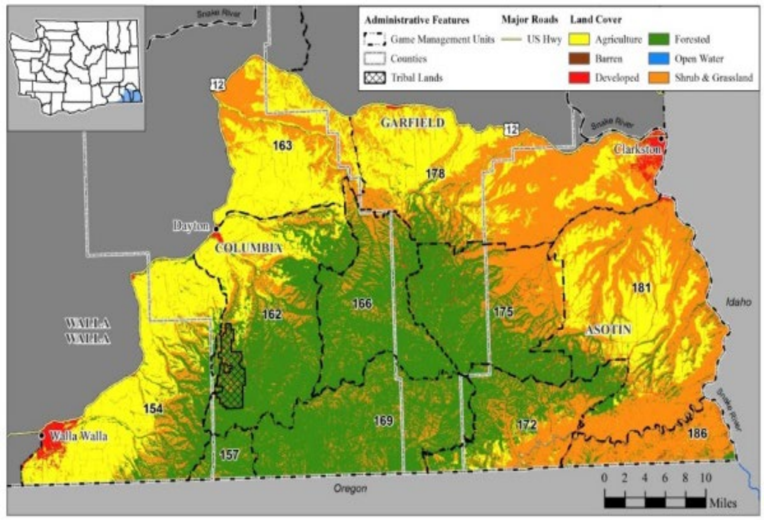

Figure 1. GMUs and generalized land cover types within the Blue Mountains WDMZ.

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. Some information is recorded for white-tailed deer during post-hunt aerial mule deer surveys and road-based composition surveys.

Estimates vary widely from year to year, with a 10-year pre-hunt mean of 41 bucks:100 does, and 49 fawns:100 does. WDFW 2021 monitoring efforts resulted in slightly lower values for bucks and fawns compared to the means, with 38 bucks:100 does and 44 fawns:100 doe ratios (Figures 2a and 2b). Road surveys for ratio estimates are not adequate to obtain a population estimate but are useful for determining population and recruitment trends. Post-hunt ratios for bucks were above the target range of 15-19 bucks:100 does, and fawn ratios indicated good recruitment rates going into winter at approximately 60 fawns:100 does.

a) b)

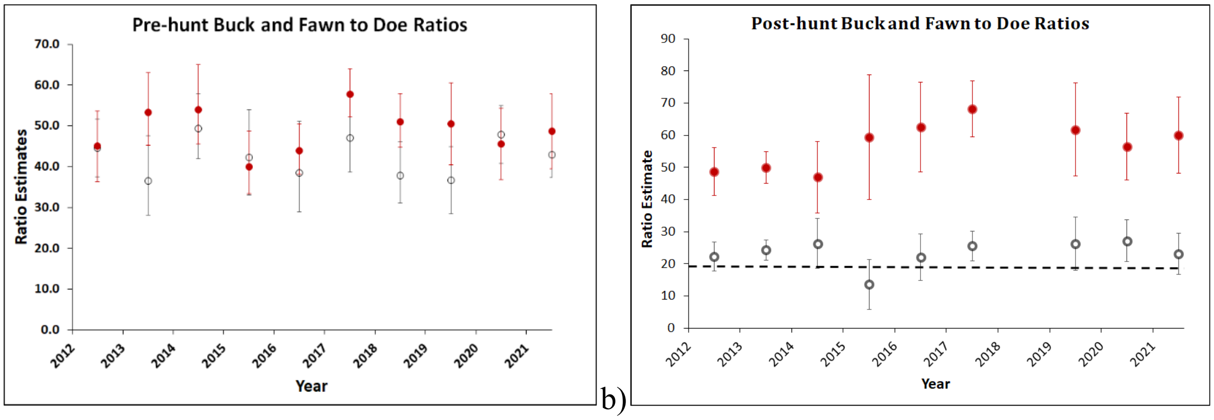

Figure 2. Estimates of buck (black) and fawn (red) ratios per 100 does and post-hunt buck objectives (dashed lines) from (a) pre-hunt (ground-based) and (b) post-hunt (aerial and ground) composition surveys in the Blue Mountains WDMZ, 2012–2021. Years where ground counts were below 100 deer have been excluded.

Hunting Seasons and Recreational Harvest

Total harvest estimates for the past ten years (Figure 3) showed a 4-year declining trend, consistent with the number of hunter days, resulting in stable values for harvest per unit effort in days (HPUE, Figure 4). This trend reversed in 2020 with a return near the 10-year average. However, harvests declined again in 2021 to well below the means for total harvest numbers and HPUE. The average general season hunter harvest is 855 white-tailed deer per season, with a harvest of less than 600 estimated for the 2021 season. Estimates of hunter days are for white-tailed and mule deer combined, and the HPUE are for white-tailed deer only; therefore, HPUE is likely underestimated.

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 recent permit change was the addition of muzzleloader antlerless permits in GMUs without general season muzzleloader opportunities. In general, there was no net increase in permits, as the Department decreased 2nd deer antlerless permits (or any species antlerless permits) for modern firearm hunters, to avoid overharvesting of antlerless mule deer. Despite adding muzzleloader antlerless permits in 2019, total antlerless permits dropped from a 10-year high of 941 in 2017 to 820 in 2018, down to 775 in 2019 and 2020 with a further reduction to 625 antlerless permits in 2021.

Following the severe hemorrhagic disease outbreak in 2021, antlerless permits have been cut again down to 265. WDFW has tried to maintain as much youth opportunity as possible, and as a percentage of total permits issued, youth permits currently comprise 22%, up from a 5-year mean of 16% and nearly double the mean of 8% prior to 2016. WDFW also incorporated the use of “any deer” permits for youth starting in 2017, which now includes permit hunts available in five GMUs.

Survival and Mortality

No estimates of pregnancy 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. This zone's predators include cougars, wolves, bobcats, black bears, coyotes, 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 has 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. More white-tailed deer are observed on the west side of the District. In addition, GMUs 154 and 162 have the highest annual white-tailed deer harvest and account for roughly 65% of the white-tailed harvest in this zone.

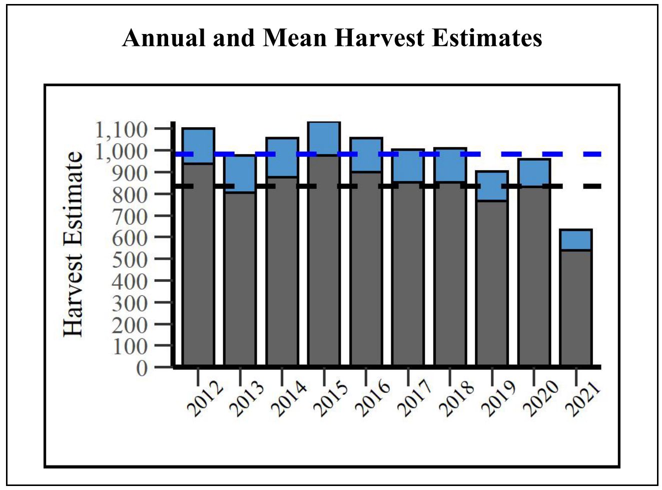

Figure 3. Harvest estimates and 10-year means (dashes lines) for General (gray) and Permit (blue) seasons in the Blue Mountains WDMZ, 2012-2021.

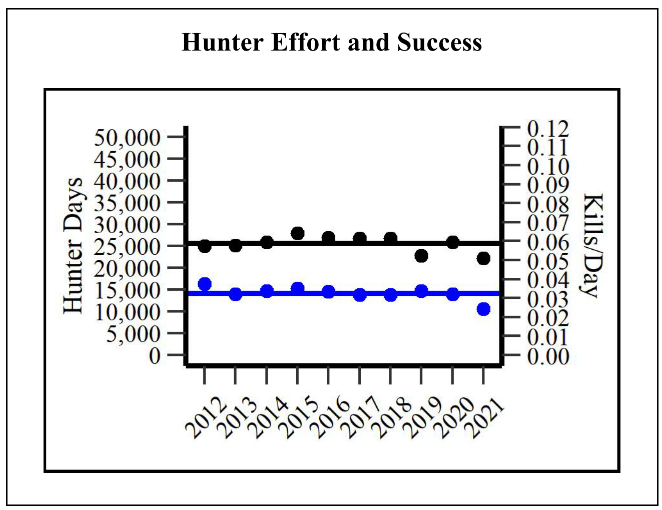

Figure 4. General season estimates (points) and 10-year means (solid lines) for hunter days (black) and HPUE (blue) in the Blue Mountains WDMZ, 2012-2021.

Human-Wildlife Interaction

The agricultural damage prevention program is managed by the WDFW Wildlife Program to minimize crop damage through multiple actions, such as the issuance of permits in designated Deer Areas, non-lethal deterrents, and Damage Prevention Cooperative Agreement (DPCA) permits. Qualifying landowners are initially allowed two free kill permits under the DPCA contract, requiring 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 that require the landowner, lessee, or their designee to purchase a damage tag and report any 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 2021 through March 2022, three hunters reported hunting with their damage tag, with one unsuccessful, one reporting a harvest of a mule deer doe, and the other with harvest of a white-tailed doe. Conflict Specialists reported eight white-tailed does harvested with landowner kill permits in GMUS 154 and 162.

Management Concerns

Over the past decade, one of the biggest management concerns for white-tailed deer in the District 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 outbreak's severity 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. Harvest trends in GMU 166 are of specific concern; the 2020 harvest declined over the improved harvest estimate in 2019, but some of this can be attributed to removing all antlerless opportunities from the GMU; however, harvest declined even further in 2021. Biologists will continue to closely monitor management actions in that unit.

Management Conclusions

Total white-tailed deer composition metrics in the Blue Mountains WDMZ are currently at management objective for the post-hunt buck:doe ratios, although white-tailed deer numbers in GMU 166 remain a management concern. Despite the recent drop in total harvest, hunter success and HPUE values indicate that the population is stable where habitat availability and quality allow.

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Columbia Basin White-tailed Deer Management Zone

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CARRIE LOWE, Wildlife Biologist
SEAN DOUGHERTY, Wildlife Biologist
JASON FIDORRA, Wildlife Biologist

Introduction

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

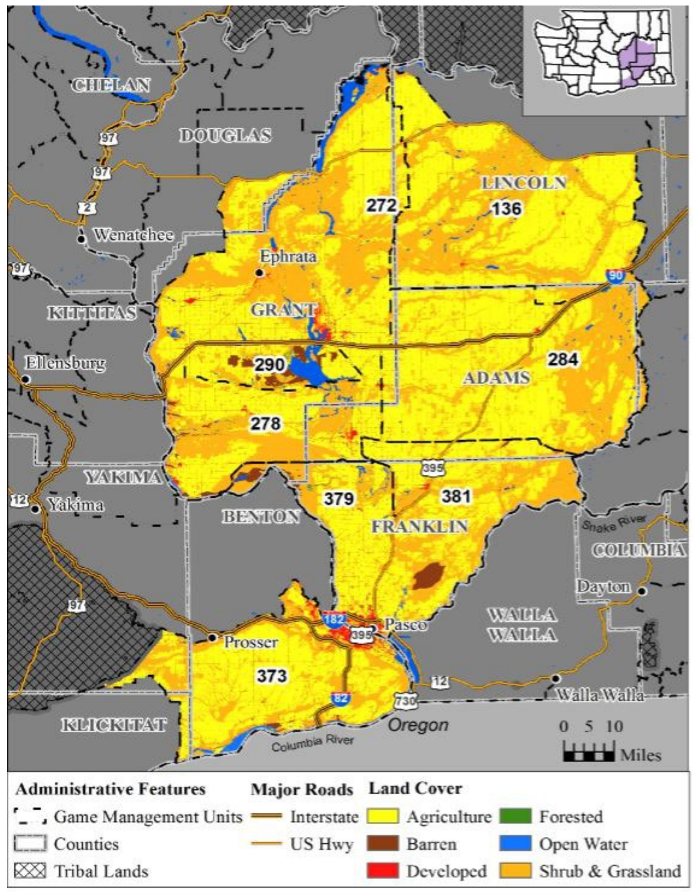

Figure 1. GMUs and generalized land cover types within the Columbia Basin WDMZ.

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, reflecting the availability of preferred habitat for white-tailed deer. However, similar to neighboring zones, there has been a negative trend in harvest over the past ten years, with the lowest harvest observed to date in 2021 (Figure 2). Measures of hunter effort (hunter days; Figure 3) and harvest rate (kills/day; Figure 3) in the zone include days spent hunting all deer (i.e., mule deer), so they are less useful as indicators of population trend but have remained relatively stable the past ten years. The decline in the harvest in 2015 is due to the drought and associated Bluetongue (BT) outbreak that year, resulting in reduced white-tailed deer numbers and recruitment. The continued negative trend in harvest since then is likely due to the hard winters of 2016/17 and 2018/19, as well as outbreaks of Epizootic hemorrhagic disease

(EHD) in 2018, 2019, and 2021 in GMU 136, where a significant amount of white-tail harvest for this zone traditionally occurs. Hunter's success and effort in this zone are 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 the harvest.

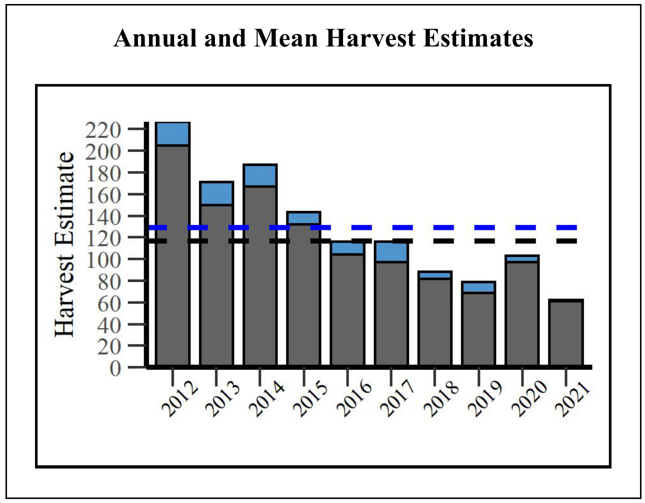

Figure 2. Harvest estimates and 10-yr means (dashed lines) for General State Harvest (gray) and General + Permit State Harvest (blue) in the Columbia Basin WDMZ, 2012-2021.

Survival and Mortality

No estimates of pregnancy, fetal, or survival rates are available for white-tailed deer in the Columbia Basin WDMZ. Like 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 occur at low levels in some parts of the Columbia Basin. Cougars are comparatively more common.

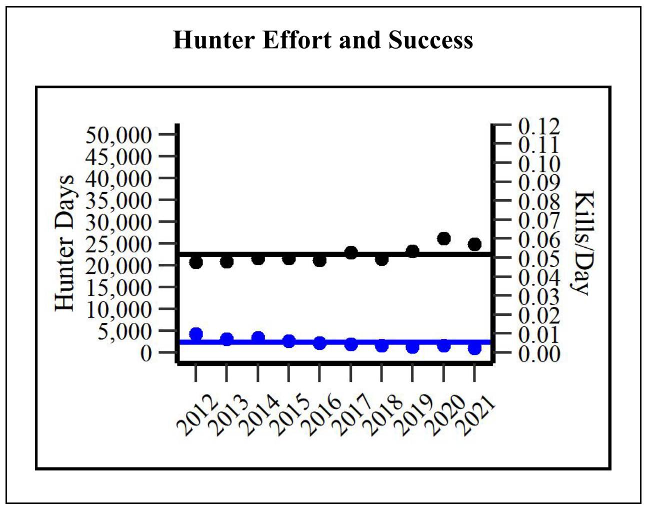

Figure 3. General season estimates and 10-yr mean for hunter days (black) and kills/day (blue) in the Columbia Basin WDMZ, 2012-2021.

Habitat

The Columbia Basin zone represents the periphery of white-tailed deer 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 significant concern in this zone, which regularly has white-tailed 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 portions of the WDMZ have had a low level of occurrence of these pathogens but also have lower numbers of white-tailed deer.

Management Conclusions

White-tailed deer populations in the Columbia Basin WDMZ are below the management objective based on harvest data that indicate a declining population. To quicken the pace of recovery, WDFW removed all general season antlerless opportunities in GMU 136 in 2021. The only exception is for youth hunters that can still harvest an antlerless white-tailed deer, but only during the last weekend of the general modern firearm season.

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. 124 pp. [2010 WA State White-tailed Deer Management Plan.]

North Cascade Mountains White-tailed Deer Management Zone

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JEFF HEINLEN, Wildlife Biologist

Introduction

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

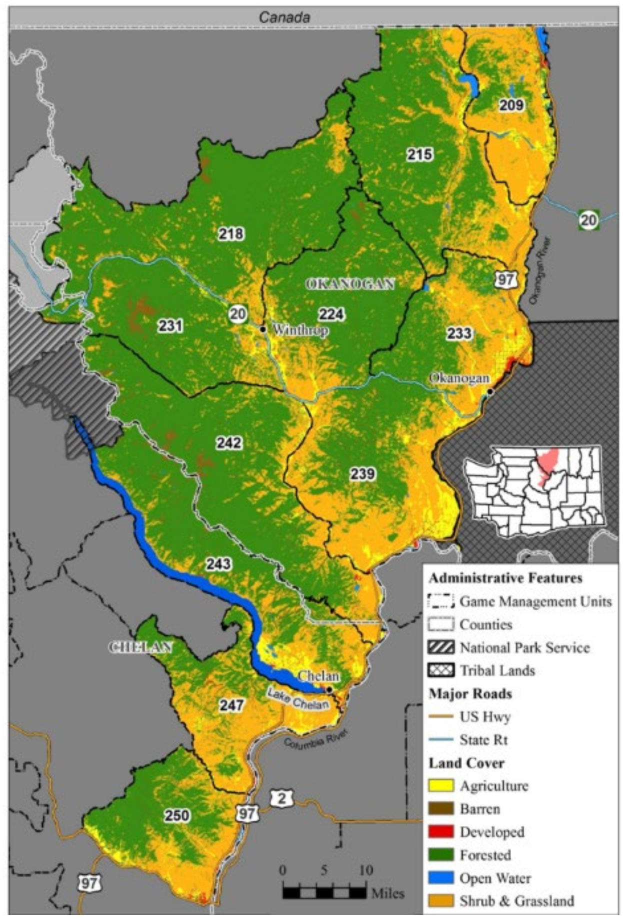

Figure 1. GMUs and generalized land cover types within the North Cascade Mountains WDMZ.

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 ten years have been low compared with mule deer harvest but relatively stable (Figure 2). 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 3); expected since many hunters will harvest either species opportunistically during the general seasons.

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 black bears, bobcats, cougars, coyotes, golden eagles, and gray wolves. The effects of predation on white-tailed deer in this zone are unknown but not considered population-limiting.

An outbreak of bluetongue and epizootic hemorrhagic disease occurred within this zone in late summer 2021. It is unknown how many white-tailed deer died from this outbreak, but mortalities were confirmed in several locations.

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.

Large, landscape-scale wildfires are becoming more frequent within this zone. Wildfires can create an immediate loss of habitat but typically improve summer forage quality in the years following. Loss of forage on the winter range and reduced concealment cover take longer to recover after wildfires and may increase winter fawn mortality for several years post-fire. Also becoming more frequent are summer heat and droughts that can reduce the quality and quantity of available deer forage, which can affect the ability of animals to accrue adequate fat stores for winter and can result in reduced fawn production/ recruitment.

Annual and Mean Harvest Estimates

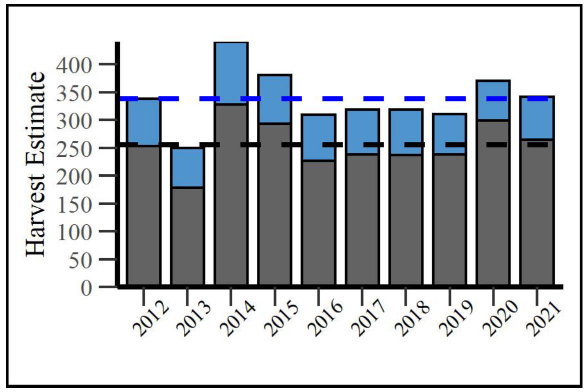

Figure 2. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray) and General + Permit State Harvest (blue) in the North Cascade Mountains WDMZ, 2012-2021.

Hunter Effort and Success

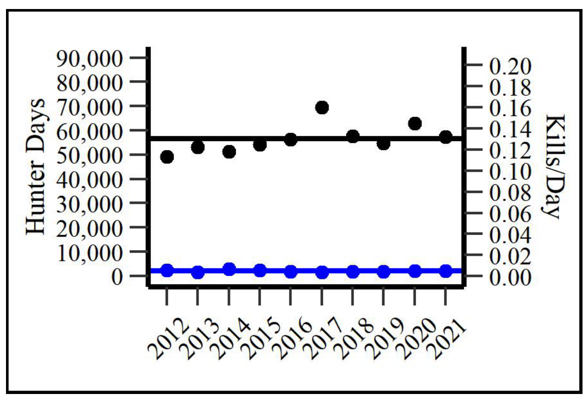

Figure 3. General season estimates and 10-yr mean for hunter days (black) and kills/day (blue) in the North Cascade Mountains WDMZ, 2012-2021.

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 reported damage incidents. To date, the program is operating smoothly and appears to help reduce deer damage complaints. Damage Prevention Cooperative Agreements (DPCA) and Kill permits are also conservatively issued to reduce deer damage throughout the Zone. In 2021, WDFW Conflict Specialists issued only five 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 between the towns of Riverside and Tonasket, Washington. The Okanogan Trails Mule Deer Foundation Chapter, Conservation Northwest, the Colville Confederated Tribes, other local, state and national partners, and the Washington State Department of Fish and Wildlife are working with the Washington Department of Transportation to install fencing and underpasses along this segment of State Highway 97 to reduce roadkill and provide safer passage. In 2020, WDOT completed one mile of deer fencing on either side of State Highway 97 running south of the Janis Bridge (with associated gates and cattle-guards at access roads). Additionally, the Janis Bridge was renovated to serve as a wildlife undercrossing.

Management Concerns

Chronic loss of habitat to development and recurring loss of winter-range shrub forage to wildfires are primary management concerns in the northern three-fourths of the zone. Degradation of summer range habitat due to a warming climate and increasing drought frequency and intensity is also an issue. In addition, more frequent and severe outbreaks of adenovirus and hemorrhagic diseases potentially related to climate change are also growing concerns.

Management Conclusions

White-tailed deer populations in the North Cascade Mountains WDMZ are currently healthy, 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. 124 pp. 2010 WA State White-tailed Deer Management Plan.

Okanogan Highlands White-tailed Deer Management Zone

JEFF HEINLEN, Wildlife Biologist
ANNEMARIE PRINCE, Wildlife Biologist

Introduction

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

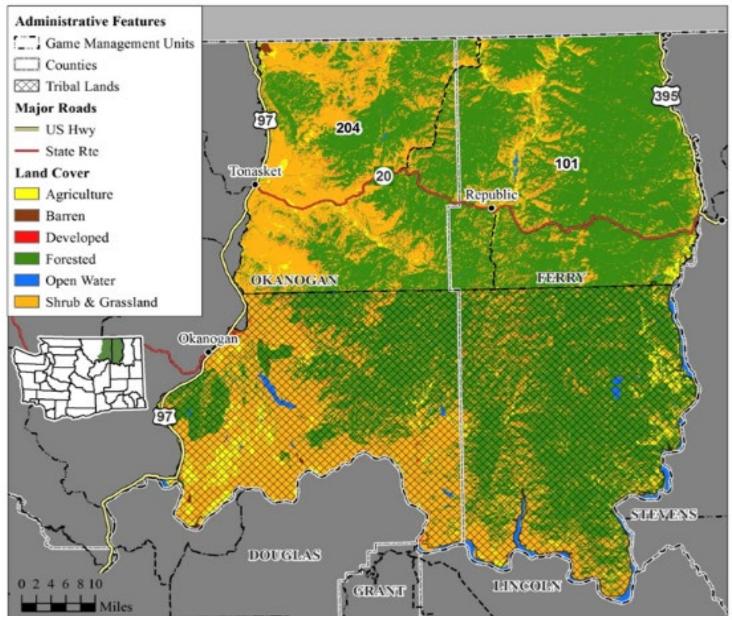

Figure 1. GMUs and generalized land cover types within the Okanogan Highlands WDMZ.

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).

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 were conducted in the past in the east half of the zone to estimate buck:doe ratios (a rough annual measure of the effect of harvest on the population) over time. In 2021, WDFW conducted no pre-hunt surveys within this zone. However, the forested landscape and limited visibility experienced during road surveys in this zone generally result in low sample sizes, which prevent the calculation of confidence intervals and limit any conclusions that biologists can make about the status of the population in the Okanogan Highlands.

Hunting Seasons and Recreational Harvest

Since 2017, harvest estimates have been below the 10-year average. The number of hunter days reported held near the 10-year average until it dipped slightly below in 2019 and slightly above in 2020. Kills/day and harvest have declined below the 10-year average since 2017 (Figures 2 & 3).

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. This zone's predators include cougars, bobcats, black bears, gray wolves, coyotes, 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 makes up the next highest level in land cover classes, comprising approximately 41% of the Okanogan Highlands WDMZ area. Combined cover classes 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 the 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 land, with the remaining 50% comprised of the Colville Indian Reservation (WDFW, 2010).

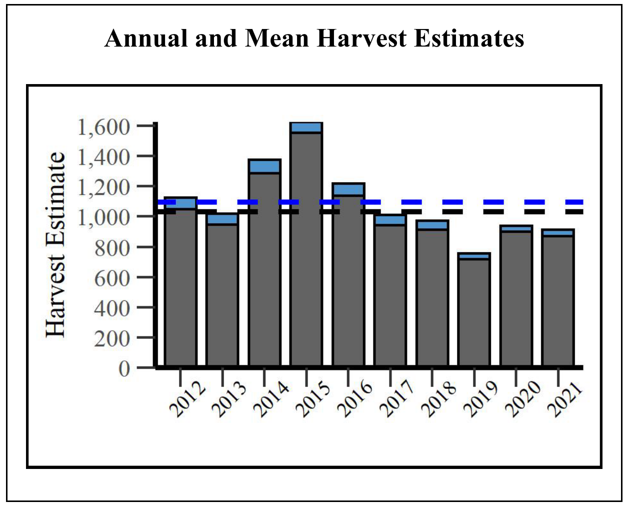

Figure 2. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray) and General + Permit State Harvest (blue) in the Okanogan Highlands WDMZ, 2012-2021.

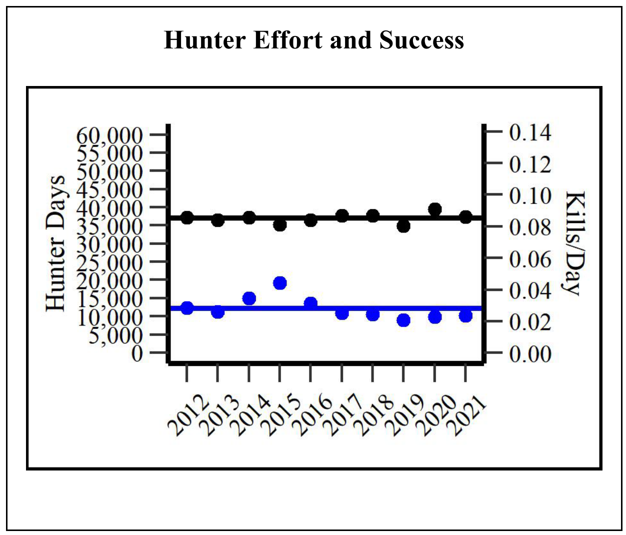

Figure 3. General season estimates and 10-yr mean for hunter days (black) and kills/day (blue) in the Okanogan Highlands WDMZ, 2012-2021.

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. Large landscape-scale wildfires are becoming more frequent within this zone. Wildfires can create an immediate loss of habitat but typically improve forage quality in the years following. Loss of forage on the winter range and reduced concealment cover take longer to recover. In 2021, approximately 70,000 acres were burned due to wildfires.

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 reported damage incidents. The program is operating smoothly and appears to help reduce deer damage complaints. Damage Prevention Cooperative Agreements (DPCA) and kill permits are also conservatively issued to reduce deer damage throughout the zone.

For example, in 2021, WDFW Conflict Specialists issued ten (mule deer and white-tailed deer) of these permits to address deer damage within GMU 204 of the Okanogan Highlands WDMZ. Within GMU 101, Conflict Specialists issued 22 (mule deer or white-tailed deer) damage prevention permits to address the damage.

Research

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

Management Concerns

Less than half the land base comprising the Okanogan Highlands WDMZ is in public ownership (31%), so maximizing hunting opportunities largely depends on securing access to private lands. Closely coupled with this concern is the availability of cultivated cropland cover, particularly cereal grain and alfalfa hay, to the deer. Cultivated crops are a major driver of 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 native carnivores, domestic dogs, and road kills from vehicle collisions. Periodically, but unpredictably, a severe winter will cause major deer loss. Also, unpredictable but becoming more frequent are summer heat and droughts that can foster conditions for severe outbreaks of hemorrhagic disease, reduce available forage deer need to accrue adequate fat stores for winter, and can also result in reduced fawn recruitment. The influence of these diverse factors can greatly complicate how best to balance deer hunting opportunities with herd sustainability. The winter of 2021 was mild to moderate; however, there was a large-scale outbreak of bluetongue and epizootic hemorrhagic disease in late summer. It is unknown how many white-tailed deer died from the outbreak, but in some areas, it may have been up to 30% of the population.

Significant roadkill occurs in the western edge of this zone along a 12.5-mile segment of State Highway 97 between the towns of Riverside and Tonasket, Washington. The Okanogan Trails Mule Deer Foundation Chapter, Conservation Northwest, the Colville Confederated Tribes, and other local, state, and national partners are working with the Washington Department of Transportation to install fencing and underpasses along this segment of State Highway 97 to reduce roadkill and provide safer passage. In 2020, WDOT completed one mile of deer fencing on either side of State Highway 97 running south of the Janis Bridge (with associated gates and cattle guards at access roads) and a renovation of Janis Bridge to serve as a wildlife undercrossing.

Management Conclusions

White-tailed deer populations in the Okanogan Highlands WDMZ are considered stable based on harvest data trends but remain below the ten year average.

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. 124 pp. 2010 WA State White-tailed Deer Management Plan.

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 in east-central Washington and consists of seven GMUs in Districts 2 and 3 (127, 130, 133, 139, 142, 145, 149; Figure 1).

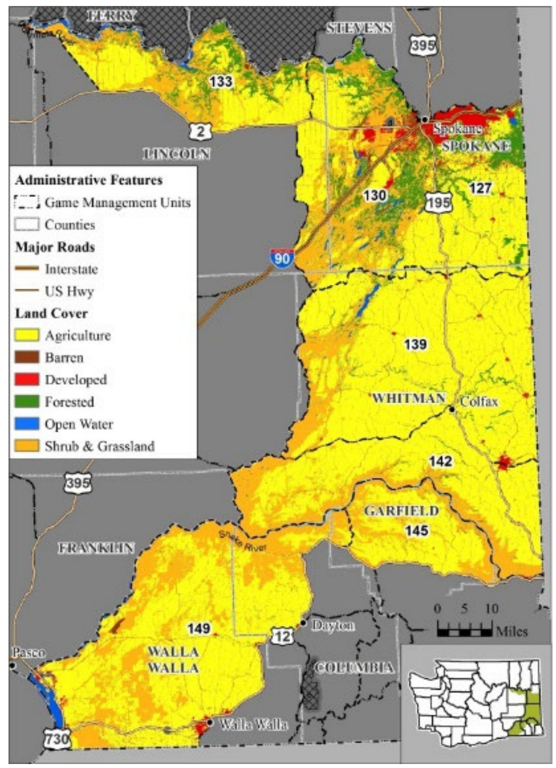

Figure 1. GMUs and generalized land cover types within the Palouse WDMZ.

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 two GMUs, but sample sizes for white-tailed deer from ground composition surveys are too small and variable to be robust indicators of the population.

For a baseline reference, biologists conducted an aerial survey in December 2017, sampling portions of GMUs 145 and 149 and obtaining a raw count of 669 white-tailed deer. They flew surveys following sightability model protocols, but the model was not designed nor validated for white-tailed deer, so WDFW did not calculate survey area estimates. 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).

Researchers conducted a survey in the same area but in 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. During 2021 pre-hunt road surveys, biologists counted 246 white-tailed deer in August for a ratio of 57 bucks per 100 does, and 109 deer in September for a ratio of 65 fawns per 100 does. Post-hunt surveys that same year resulted in only 11 white-tailed deer being counted due to a combination of disease impacts, lower count effort, and insufficient data to calculate classification ratios.

North Palouse

Pre-hunt ground surveys are conducted throughout the North Palouse. These surveys aim 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. The ratio data indicates stable buck recruitment outside the spike in 2019 (Figure 2). Production of fawns dipped between 2016 and 2018 but has been stable otherwise (Figure 2).

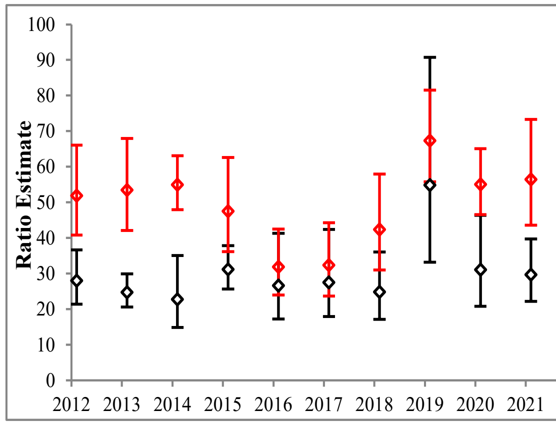

Figure 2. Estimated pre-hunt fawn:doe (◊) and buck:doe (◊) ratios and associated 90% confidence intervals in North Palouse WDMZ (GMUs 127 – 142), 2012-2021.

Drought conditions that extended well into October and the associated Bluetongue (BT) outbreak in 2015 were likely the driving factors in the decrease in production seen in 2016. The hard winter in 2016-17 likely contributed to low fawn production in 2017, and a small Epizootic hemorrhagic disease (EHD) outbreak in the northwest of this zone in 2018 likely contributed to the lower production that year. The high ratio estimates in 2019 indicated good recruitment and production, though the counts that produced these estimates were the lowest in the past ten years. As noted above, routes are not designed to estimate abundance; however, the low counts indicate that the 2018/19 winter extending into April impacted the overwinter survival. Ratios from 2020 and 2021 align with the long-term averages; however, the number of deer observed was still well below the previous 10-year average.

Ratio estimates should not be interpreted as an index to population abundance; they are a relative annual measure of reproduction and recruitment in the deer population 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 in 2021 declined to the lowest point observed since mandatory harvest reporting began in 2001 (Figure 3). This rapid decline is due to the population already being at a relative low point due to the weather and disease issues noted above and then being hit in 2021 by a severe drought and EHD outbreak. Estimates of hunter effort and kills/day have also declined to their lowest point since mandatory reporting began (Figure 4).

Because estimates of hunter effort (i.e., hunter days; Figure 4) are not white-tailed specific and include days spent hunting mule deer, while kill data is specific to white-tailed deer, kills/day estimates are biased low, but the trends WDFW are observing are not likely due to this bias alone.

Given the trends in harvest data and pre-season ratios, all general season antlerless opportunity was removed in GMUs 127 through 142 in 2021. The only exception was for youth hunters that can still harvest an antlerless white-tailed deer, but only during the last weekend of the general season. These reductions will be maintained going forward until the population has recovered.

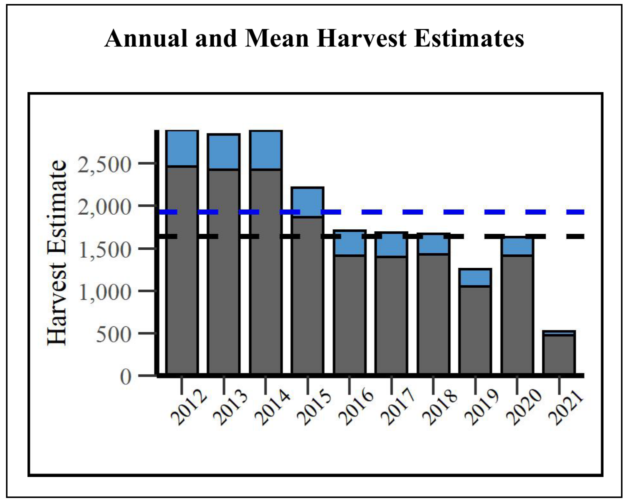

Figure 3. Harvest estimates and 10-yr means (dashed lines) for (a) General State Harvest (gray) and General + Permit State Harvest (blue) in the Palouse WDMZ, 2012-2021.

The South Palouse currently comprises roughly 18% of the total Palouse harvest. Although this portion of the Palouse Zone has yet to experience BT and EHD to the same degree as the North Palouse based on public reports, harvest changes have followed a similar pattern. Although individual GMUs show very different harvest trends, GMUs 145 and 149 showed significant white-tailed deer harvest declines in 2021, well below the previous 5-year averages. This decline follows a promising increase in harvest trends following a good 2020 harvest. Although antlerless permit numbers have increased since 2013 in response to damage complaints and high general season harvest success (indicating more available harvest opportunities), WDFW decreased permit numbers in 2018 in response to harvest declines. Most of the current antlerless harvest can be attributed to Youth/Senior/Disabled general seasons and early and late general archery season opportunities. The Department will continue to monitor the general season harvest to determine if antlerless opportunities should be managed through the permit system.

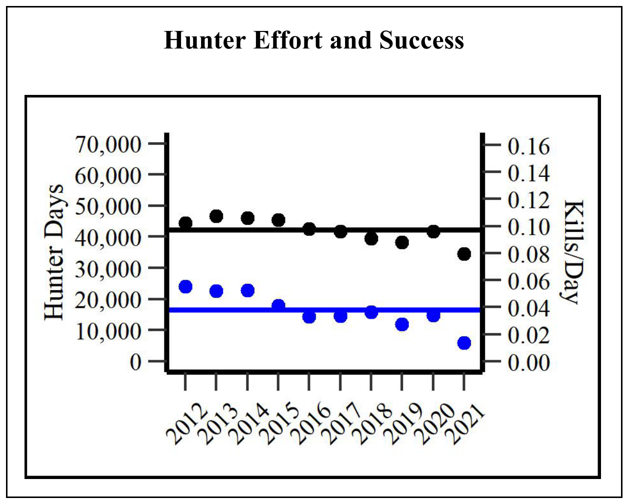

Figure 4. General season estimates and 10-yr mean for hunter days (black) and kills/day (blue) in the Palouse WDMZ, 2012-2021.

Survival and Mortality

No estimates of pregnancy, fetal, or survival rates are available for white-tailed deer in the Palouse WDMZ. Like mule deer, sources of mortality in this zone include harvest, collisions with vehicles, poaching, disease, and predation. Predator species living in 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. Surveyors observe fewer white-tailed deer than mule deer along the Snake River breaks, 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 associated with agricultural fields. White-tailed deer have also taken advantage of larger acreage (10-20-acre) semi-rural development where forage and cover are 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 works with the Washington State Department of Transportation to troubleshoot hot spots.Additionally, crop damage is reported annually in some portions of all GMUs in the North Palouse. It will likely increase as farmers switch to higher-value crops like garbanzo beans. Antlerless harvest is the primary tool used to address crop damage. In the South Palouse, WDFW applies it 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, as well as at the individual landowner scale through damage and kill permits. In the North Palouse, WFDW has removed most general and permit season white-tailed deer antlerless opportunities due to declines in the population; the primary tool for addressing damage will be at the individual landowner scale until this population recovers.

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 white-tailed deer. In response to increasing damage complaints, antlerless permit numbers have increased by 200 across both GMUs since 2013, with 45 permits specifically for white-tailed deer. With the recent disease impacts on the population, antlerless permits in GMU 145 and 149 have dropped to 85 total, with no permits specifically for white-tailed deer. Like the North Palouse Zone, WFDW will address damage issues by working with individual landowners.

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 makes up the next highest level in land cover classes, comprising approximately 41% of the Okanogan Highlands WDMZ area. Combined cover classes 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 the 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 land, with the remaining 50% comprised of the Colville Indian Reservation (WDFW, 2010).

Management Concerns

Mass conversion of natural habitats to agriculture occurred over the past century but represents relatively minor changes today. Gains have been made in deer habitat with the enrollment of agricultural acres into the Conservation Reserve Program (CRP). However, with current wheat, lentil, garbanzo bean, and hay prices, several landowners have chosen to only 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 are not 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 displace deer permanently. While low-density development incorporates more habitat, the 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, hoping to maintain 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. These disease events can be more severe during droughts and affect white-tailed deer herds across multiple Management Zones. Drought occurred in 2015 and 2021 when white-tailed deer deaths related to EHD & BT were reported in the Palouse, Columbia Basin, and Selkirk WDMZs. Given climate change and the trend toward warmer, dryer summers, more cases of BT and EHD outbreaks in the future are likely.

Management Conclusions

Based on harvest metrics and survey data, white-tailed deer populations in the Palouse WDMZ appear to have declined. Due to their naturally high reproductive potential, white-tailed deer populations generally rebound quickly from weather and disease-related events (McCullough, 1987). However, due to the number of events in near back-to-back succession and to support faster recovery, WDFW has reduced antlerless harvest opportunities and will continue at this reduced level until the population has recovered.

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Selkirk White-tailed Deer Management Zone

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

Introduction

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

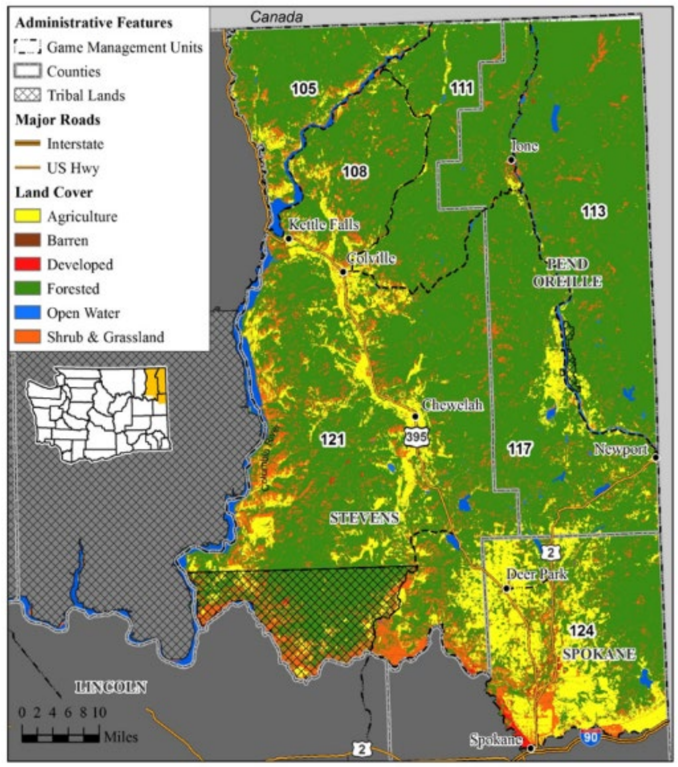

Figure 1. GMUs and generalized land cover types within the Selkirk WDMZ.

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 six 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 forests in the foothills and mountains. Many 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

A reliable estimate of deer population size for this zone has yet to be attainable due to forest cover, deer behavior, staff availability, and funding limitations. As a result, pre-hunt 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 ten years (Figure 2) indicate no significant change since 2013. The 2021 fawn:doe ratio for GMUs 105-121 was 62:100 (90% CI = 50-75). This estimate is similar to 2020 and, except for 2013, higher than the estimates calculated over the previous ten years.

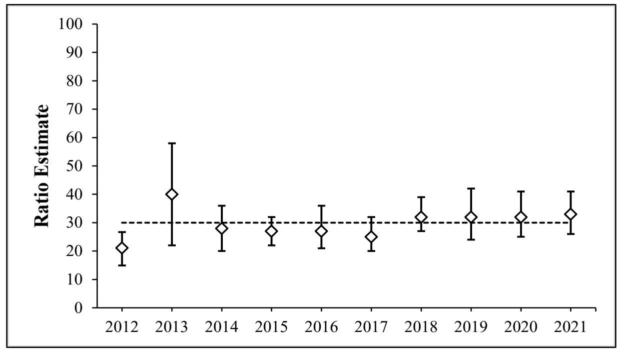

Figure 2. Estimated pre-hunt buck:doe ratios, 90% CIs, and 10-yr average (dotted line) for GMUs 105-121 in the Selkirk WDMZ, 2012-2021.

In GMU 124, the pre-hunt buck:doe ratio estimate was 33:100 (90% CI = 24-45, *n* = 549) in 2021, high compared to the previous 10-yr average of 25:100. The fawn:doe ratio estimate was 58:100 (90% CI = 48-71, *n* =443) in 2021, in line with the previous10-year average of 55:100. It should be noted that WDFW completed these surveys before the full impact on the population from the severe 2021 Bluetongue and Epizootic Hemorrhagic Disease (EHD) outbreak.

Hunting Seasons and Recreational Harvest

Estimates of white-tailed deer harvest in this zone declined between 2008 and 2011, coincident with two consecutive harsh winters in 2008 and 2009, which suppressed fawn recruitment (Figure 3). In addition, populations declined from 2015 to 2019, likely due to a widespread 2015 blue-tongue outbreak, followed by severe winters in 2016/17 and 2018/19. Due to their naturally high reproductive potential, white-tailed deer populations generally rebound quickly from such temporary weather and disease-related events (McCullough, 1987). However, due to the number of events in a short period and to support faster recovery, WDFW reduced antlerless harvest opportunity. Estimates of harvest and kills/day (Figure 3) and ratio estimates from our annual ground surveys indicate populations are still below the pre-2015 level.

Survival and Mortality

The 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 bears, grizzly bears, bobcats, coyotes, gray wolves, 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 late summer 2015 and 2021, these disease events can be more pronounced and affect 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 and 2021, 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, 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 the 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).

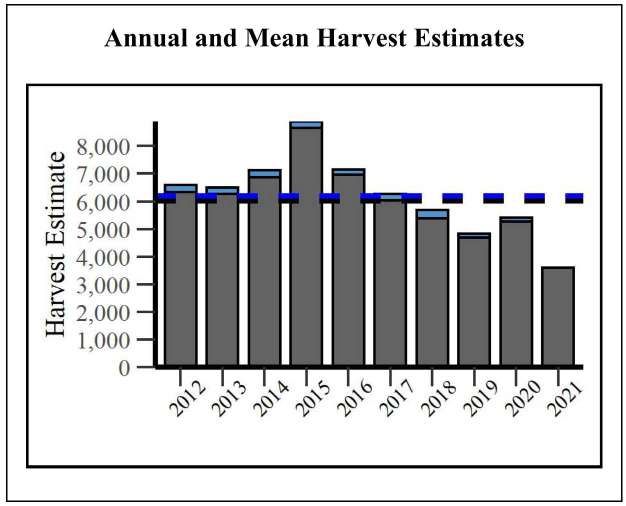

Figure 3. Harvest estimates and 10-yr means (dashed lines) for General State Harvest (gray) and General + Permit State Harvest (blue) in the Selkirk WDMZ, 2012-2021.

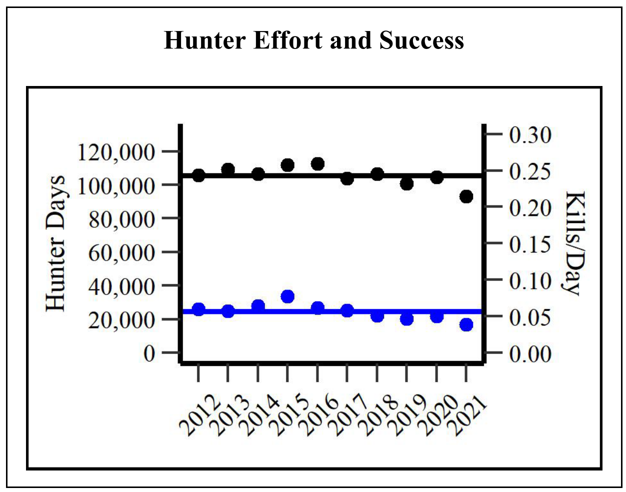

Figure 4. General season estimates and 10-yr mean for hunter days (black) and kills/day (blue); in the Selkirk WDMZ, 2012-2021.

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 human-wildlife conflict and deer mortality due to vehicle collisions. For example, a study on collision rates in Washington indicates that deer-vehicle collisions in this zone are consistently among the highest in the state (Myers et al., 2008). In 2021, 65 white-tailed deer damage prevention permits and 20 kill permits were issued to landowners experiencing issues with deer damaging their crops.

Research

Henderson (2014) examined how habitat quality influences the migratory strategy of female white-tailed deer within the Selkirk WDMZ. An evaluation was accomplished on the influence of deer access to high-quality winter habitat using GPS-collared female white-tailed deer. The study was based on the probability of individual migration, 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 with this concern is the availability of cultivated cropland cover, particularly cereal grain and alfalfa hay, to the deer. Cultivated crops are a major driver of 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 native carnivores and domestic dogs, and road kills from collisions with automobiles on public roadways. Periodically but unpredictably, severe winters will cause major deer loss. Also unpredictable are summer heat and drought, which foster conditions for severe hemorrhagic disease outbreaks. The influence of these diverse factors can greatly complicate how best to balance deer hunting opportunities with herd sustainability.

Management Conclusions

White-tailed deer populations in this zone have declined in recent years but remain within management objectives based on harvest, survey, and survival data available for the zone.

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Islands Black-tailed Deer Management Zone

KURT LICENCE, Wildlife Biologist
MIKE SMITH, Wildlife Biologist

Introduction

The Islands Black-tailed Deer Management Zone (BDMZ) is located in the Puget Sound in northwest Washington and consists of 13 GMUs (410-417 and 419-424; Figure 1).

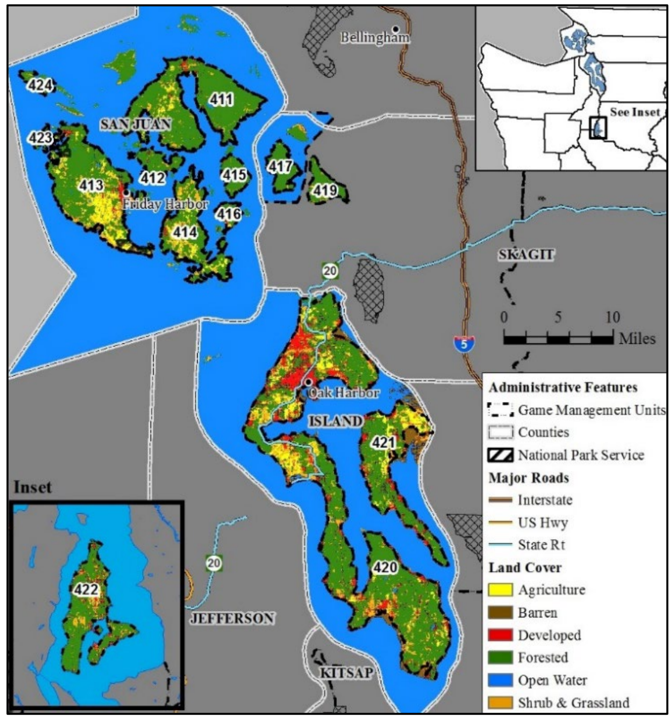

Figure 1. GMUs and generalized land cover types within the Islands BDMZ.

Management Guidelines and Objectives

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

Population Surveys

No population surveys are being conducted by WDFW in the Islands BDMZ at this time. Prior to the spring of 2021, annual harvest estimates and anecdotal reports from island residents suggested a stable to increasing population. However, Adenovirus Hemorrhagic Disease (AHD) was detected on San Juan and Orcas Islands during May 2021, and on Whidbey Island during September 2021. Public reports also indicate that AHD may have impacted other islands in the San Juan Archipelago (e.g., Lopez, Henry, Shaw, Center, Stuart and Blakely). Deer abundance in AHD-affected areas is likely significantly lower than in previous years. AHD has not been detected in 2022 as of August.

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. In 2020, the Island BDMZ general season harvest (Figure 2) was the highest that it had been in the previous decade, although hunter participation (hunter days) was similar to the 10-year average (Figure 3). The above-average general season harvest and kills/day likely indicated a stable to increasing population before the 2021 AHD outbreak. In 2021, both harvest estimates and hunter participation dropped well below the 10-year average.

A total of 671 deer were harvested from the Island BDMZ during the 2021 general seasons, the majority (77%) were antlered bucks. Modern Firearm hunters experienced the highest success rate

(50%) and were most likely to harvest an antlered buck. Archery and Muzzleloader hunters experienced low success rates at 12% and 2%, respectively. Most of the islands in the BDMZ offer antlerless-only second tag special permits to reduce deer densities and increase hunting opportunities. In 2021, the number of available special permits in the BDMZ was 1,200. Of the 1,200 special permits available, 1,031 were awarded and claimed by applicants. A total of 64 antlerless deer were harvested in the BDMZ by special permit during the 2021 season.

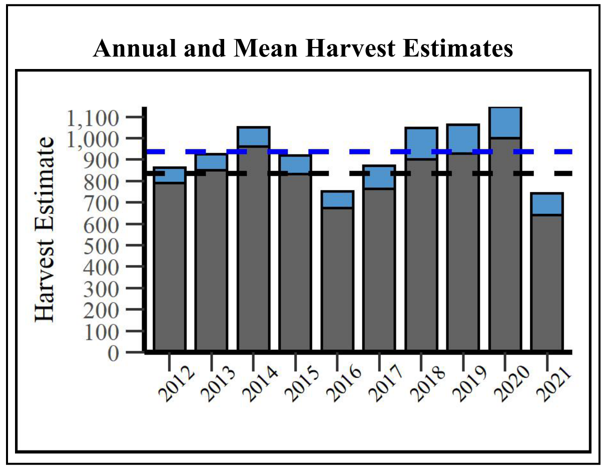

Figure 2. Harvest estimates and 10-yr mean (dashed lines) for General State Harvest (gray) and General + Permit State Harvest (blue) in the Islands BDMZ, 2012-2021.

Publicly owned land is extremely limited in the Islands 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 "2022 District 13 Hunting Prospects", available on the WDFW website.

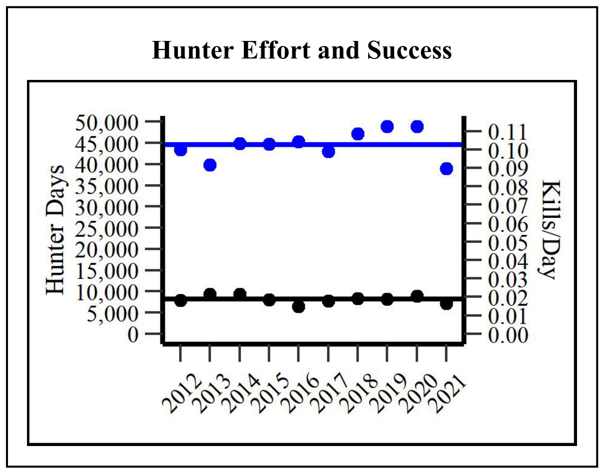

Figure 3. General season estimates and 10-yr mean for hunter days (black) and harvests/day (blue) in the Islands BDMZ, 2012-2021.

The season dates and weapon type regulations for antlerless-only second tag special permits were recently restructured for several GMUs, including GMU 411 (Orcas), GMU 412 (Shaw), GMU 413 (San Juan), GMU 414 (Lopez), GMU 415 (Blakely), GMU 420 (Whidbey), and GMU 422 (Vashon-Maury). The new regulations allow permit holders to hunt August 1st - December 31st using any legal weapon (archery, muzzleloader, modern firearm—firearm type restricted). Centerfire rifles are not permitted for use because all the affected GMUs are in firearm-restricted areas. All deer hunters afield in these GMUs must wear hunter orange or hunter pink during the general season and extended second deer permit season because modern firearm hunters may be afield during the entire duration of the seasons.

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 collisions with vehicles, disease, poaching, and predation by coyotes (the sole large predator in this zone, but absent in the San Juan Archipelago) on Whidbey, Camano, Cypress, Guemes, and Vashon Islands.

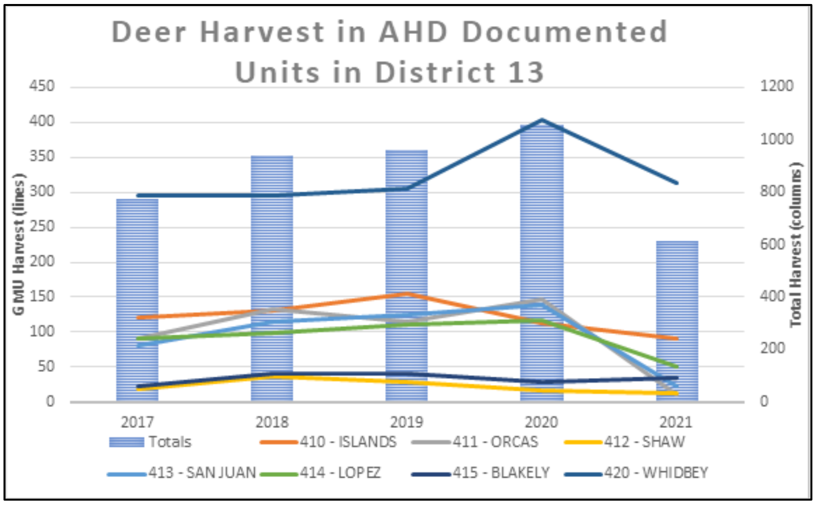

Figure 4. Deer harvest in AHD impacted GMUs in District 13 2017-2021.

Adenovirus Hemorrhagic Disease (AHD) substantially increased the number of deer mortalities in the San Juan Archipelago during the late spring and summer of 2021. Orcas and San Juan Islands appear to have been impacted the most, with roughly 210 reported AHD-related mortalities on Orcas Island and 115 on San Juan Island. These figures are an underestimate of the actual number of AHD-related mortalities. AHD appears to have also impacted deer on Lopez, Shaw, Henry, and Blakely Islands to different degrees. For example, deer harvest success on San Juan and Orcas islands dropped significantly (84% and 93% respectively) between 2020 and 2021, while harvest on Blakely Island increased slightly (Figure 4).

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. Robust deer populations may be supported by expanded edge habitats and inadvertent forage enhancements such as gardens and ornamental plantings, which provide abundant food in safe environments where hunting is controlled.

Human-Wildlife Interaction

Vehicle collisions are common on all the larger islands in this BDMZ. Deer may be encountered 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. During the previous year, two deer permits were issued on Whidbey Island, but neither were filled. Deer depredation has altered the understory habitat conditions and reduced avian species' diversity 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 seeds needed for restoration projects.

Management Concerns

In 2013, most of the islands in the BDMZ were split into individual GMUs to better understand hunter access and harvest trends on each island where deer occur. Previously, all the islands were combined into one or two large GMUs. Despite outreach efforts to educate hunters of the change, hunters continue to report their harvest using the previously assigned GMU number, thus hindering WDFW's 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. The immediate and long-term impacts of last year's Adenovirus Hemorrhagic Disease outbreak are not well known. It appears that deer abundance on impacted islands in the San Juan Archipelago is substantially lower. As suspected, deer harvest on these islands was lower during the 2021 season than during previous years, but populations and associated harvest are expected to rebound quickly in the coming seasons.

Management Conclusions

Based on harvest data, black-tailed deer populations in the Islands BDMZ were at or above management objective with an increasing trend. However, deer populations on Adenovirus Hemorrhagic Disease impacted islands may have substantially decreased during the spring and summer of 2021. Regardless of the current abundance of deer on AHD-impacted islands, the long-term objective of wildlife managers has been to reduce and maintain a lower deer abundance in the Islands BDMZ. Consequently, hunters can anticipate liberal hunting seasons in future years with the goals of stabilizing and decreasing deer abundance within the Islands BDMZ.

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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 in northwest Washington and consists of 11 GMUs (407, 418, 426, 437, 448, 450, 454, 460, 466, 485, and 490; Figure 1).

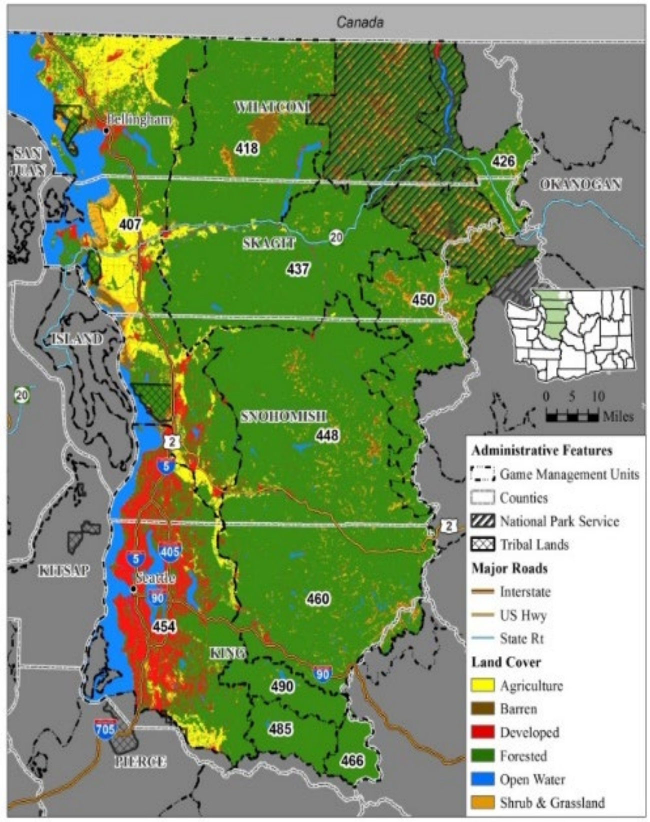

Figure 1. GMUs and generalized land cover types within the North Cascade Mountains BDMZ.

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. Other management objectives include managing for a post-hunt population with a sex ratio of approximately 15–19 bucks:100 does (WDFW, 2014).

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 generally stable.

In May 2021, WDFW detected Adenovirus Hemorrhagic Disease (AHD) in the adjacent Islands BDMZ. It quickly spread to other areas within that zone and was eventually confirmed in GMU 407 of the North Cascade Mountain BDMZ in June 2021. The full impact of the outbreak in GMU 407 is unknown, with most mortalities likely occurring in northern urban and suburban areas of the GMU. Public mortality reports and no confirmed cases within the area this year indicate that the impacts of the outbreak in this BDMZ likely are minimal. This is likely due to the natural segregation and lower densities of black-tailed deer in the upland forests within this zone. As of mid-August, no cases of AHD have been confirmed in 2022.

Hunting Seasons and Recreational Harvest

Harvest estimates for the past ten years generally indicate a steady to declining harvest trend (Figures 2 and 3). Like the 2020 harvest estimate, the 2021 harvest estimate, including general season and special permits, was below the 10-year average (Figure 2). In addition, the number of hunter days and kills per day fell slightly below the 10-year average (Figure 3). Overall, the consistent long-term harvest rates (kills/day) in this zone indicate a stable population (Figure 3).

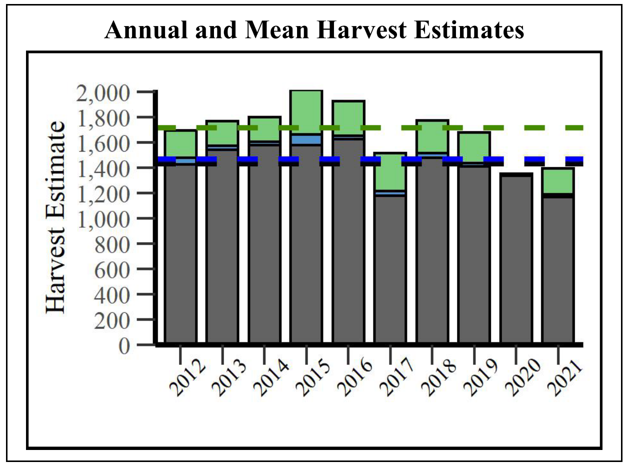

Figure 2. Harvest estimates (dashed green line) and 10-yr mean (dashed blue line) for General State Harvest (gray), General State + Permit State Harvest (blue), and General + Permit + Tribal Harvest (green) in the North Cascade Mountains BDMZ, 2012-2021.

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, harvest trends reveal no concerns about the vital rates for adult females. In general, estimates of the annual survival of black-tailed bucks in Washington State have averaged 50 percent of the total population 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.

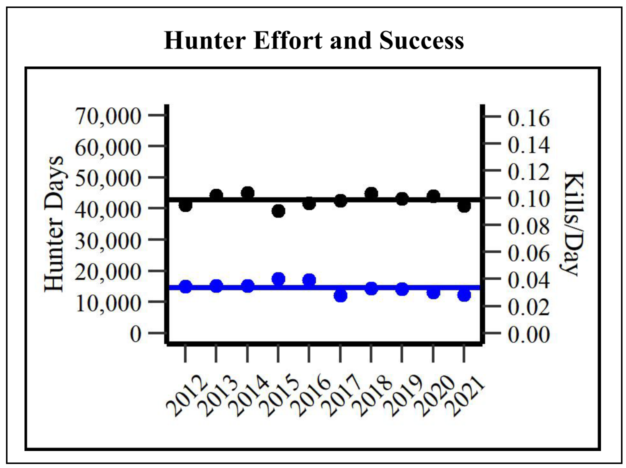

Figure 3. 10-yr mean for hunter days (black) and harvest/day (blue) in the North Cascade Mountains BDMZ, 2012-2021.

Habitat

Three primary landownership types comprise most of the huntable habitat within the North Cascade Mountains BDMZ: U.S. Forest Service, private timberlands, and state-managed forests (Deptartment of Natural Resources). Throughout Washington, changes in land-use practices have been the primary driver of declines in black-tailed deer populations (Nelson et al., 2008). Human encroachment, reductions in timber harvest, changes in timber management practices, and the natural progression of aging timber stands have contributed to a decrease in the amount and quality of local black-tailed deer habitat.

Closures of private timberland roads can buffer the influences of increased human disturbance throughout deer ranges in Skagit and Whatcom counties. However, continued use of herbicides on these private timberlands decreases forage plants important for black-tailed deer and can adversely affect the population.

Although this management practice has declined on state and federally-owned lands during the previous ten years and is of minimal concern compared to historical herbicide use levels, it is still a factor to consider when managing local deer populations and habitat quality.

In general, the long-term trend in GMU 454 deer habitat is for a continued decline. The decline is consistent with the housing and commercial development of the 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 cleared for homes. These tracts still provide and may improve deer forage availability, particularly during winter, improving overall body condition, which usually translates to higher productivity and increased survival. Further, limited hunting access may reduce mortality on private lands closed to the general public, subsequently increasing deer densities in those areas and prompting deer dispersal to surrounding habitats more accessible to hunters in GMU 454.

A significant majority of GMU 460 is managed for timber production. Annual timber harvests create a mosaic of seral stages that can benefit deer. Forest clearings of 1–10 acres and riparian corridors protected by the Washington Forest and Fish Law exist and provide a good forage base for wildlife. The forest stands in these corridors provide older age classes that diversify habitat and help intercept snow during harsh winters and 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 (approx. 90,000 acres). This action will ensure the conservation of this large area of commercial forest as open space and de facto deer habitat. The Snoqualmie Indian Tribe recently purchased roughly 12,000 acres in the NE corner of the forest. 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 depend on timber management and subsequent seral stage development because it determines forage availability. Several thousand acres of timberlands are 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 northern Region 4. However, WDFW made no crop damage compensation payments in this BDMZ in 2021. Department Conflict Specialists issued 12 damage permits to commercial producers in GMU 407 in 2021. All 12 permits were filled, with four male and eight female BTD harvested. These permits were issued to address damage to commercial strawberry and raspberry producers. In Snohomish County, one permit was issued but was not filled. Three damage permits were issued in King County, but no deer were harvested. These permits were issued for lands involved in the production of nursery and vegetable crops.

Deer Area 4541 was created in GMU 454 in 2018 to offer additional harvest opportunities and to address damage complaints in the most densely populated portion of the unit. In this area, a special permit application offered 30 antlerless permits (10 each for Second Deer, Hunters 65 and over, and Hunters with Disabilities). Of the 30 permits issued, only nine recipients reported spending at least one day afield, which resulted in no permits being successfully filled.

Management Concerns

Safety concerns associated with increased human development and changing attitudes towards hunting have resulted in fewer areas open to hunters in the North Cascade Mountains BDMZ. In addition, public hunting sites are limited in many of the North Cascade GMUs. As a result, the agency continues to look for opportunities to partner with private landowners to open more opportunities for hunters.

Management Conclusions

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

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Olympic Peninsula Black-tailed Deer Management Zone

BRYAN MURPHIE, Wildlife Biologist

Introduction

The Olympic Peninsula Black-tailed Deer Management Zone (BDMZ) is 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).

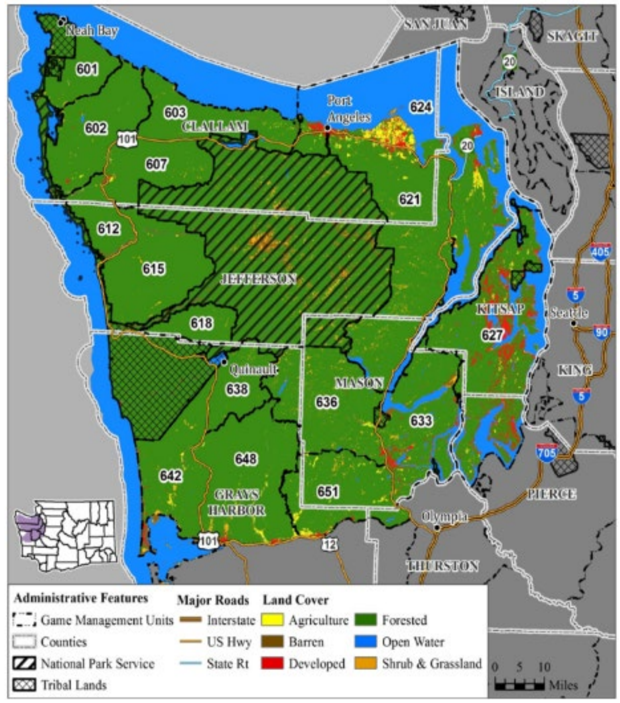

Figure 1. GMUs and generalized land cover types within the Olympic Peninsula BDMZ.

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, WDFW conducts 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; 2012-2021/22). Tribal research and monitoring also provide valuable information on black-tailed deer in this BDMZ through work conducted independently and in cooperation with WDFW.

Hunting Seasons and Recreational Harvest

The 2021 deer hunting season regulations were like previous years in the Olympic BDMZ. Most general season hunting opportunities were for any buck, while antlerless harvest was limited to certain weapon types or special permits. Deer Area 6020 was open to the harvest of any deer during the general season for all weapon types. The Olympic BDMZ provided additional hunting opportunities during the 2021 season, with 640 permits offered through the Department's special permit system; of these, 319 hunters reported harvesting 132 deer in 2021.

Estimates from harvest reports indicate 2021 buck harvest (Figure 2), kills/day, and hunter participation (Figure 3) were consistent with 10-year averages.

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. Doe survival is generally higher than 75% (Rice, 2018; McCoy et al., 2014). Buck survival has been documented to be around 50% (Bender et al., 2014). Fawn survival varies the most annually and is generally below 40% (Rice, 2018; McCoy et al., 2014; Murphie S., 2010).

Causes of mortality among black-tailed deer include nutritional stress, predation, legal harvest, poaching, and a variety of other natural and human-related causes (vehicle collisions for example). Malnutrition and predation are the most common factors associated with the mortality of does and fawns (Rice, 2018; McCoy et al., 2014; Murphie S., 2010). Hair-loss syndrome (Bildfell et al., 2004) is also an important factor influencing black-tailed deer survival (McCoy et al., 2014; Murphie S., 2010). Hunter harvest is the most common cause of mortality among bucks (Bender et al., 2014).

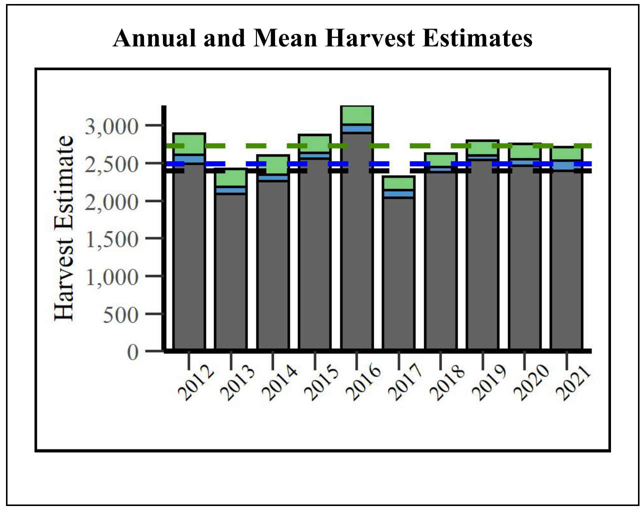

Figure 2. Harvest estimates and 10-yr means (dashed lines) for General State Harvest (gray), General State + Permit State Harvest (blue), and General + Permit + Tribal Harvest (green) in the Olympic Peninsula BDMZ 2012-2021.

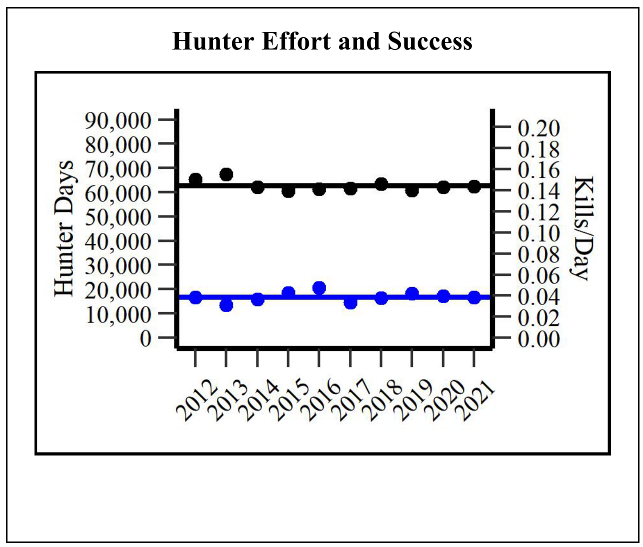

Figure 3. 10-year mean for hunter days (black) and kills/day (blue) in the Olympic Peninsula BDMZ, 2012-2021.

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 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 habitats that include a diverse mix of stand-ages, which benefit 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

No research on deer in the Olympic BDMZ was conducted during this review period.

Human-Wildlife Interaction

In the Olympic BDMZ, most 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 to increase harvest levels. These efforts often have limited value due to local shooting ordinances that reduce deer hunting activity despite the liberalized seasons. Landowners can work 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, which may include both lethal and nonlethal measures. Wildlife Conflict specialists may issue landowners damage prevention/harvest permits, remove deer under an agency action, or deploy Master Hunters to remove deer or conduct non-lethal activities, such as hazing.

In response to chronic damage/conflict issues, liberal deer hunting seasons have been established in GMUs 624, 627, and 633. Forty 2nd-deer permits were available in the portion of GMU 624 designated as Deer Area 6020, but participation and success were quite low; four hunters reported harvesting two does in 2021. 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 and permit season antlerless harvest in GMU 624 was reported to be 40 in 2021, and the 10-year average is 49. The Department issued four damage prevention/harvest permits within the Olympic BDMZ, two deer were harvested.

Management Concerns

The 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 hunting access 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.

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South Cascade Mountain Black-tailed Deer Management Zone

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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).

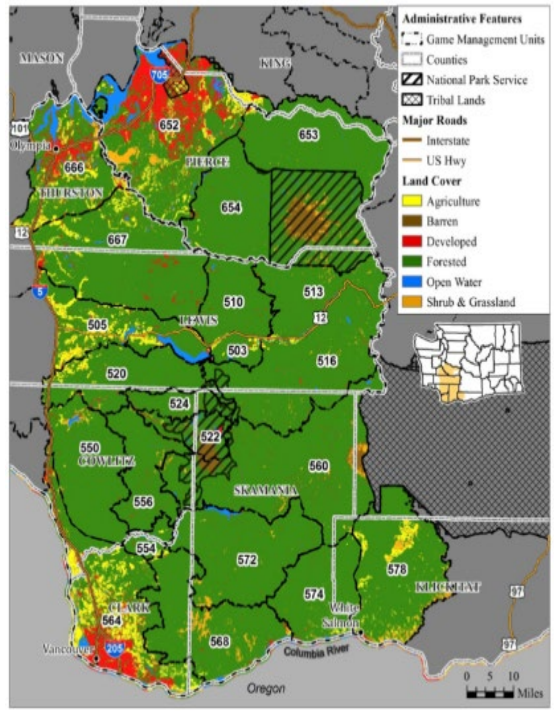

Figure 1. GMUs and generalized land cover types within the South Cascade Mountains BDMZ.

Management Guidelines and Objectives

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

Population Surveys

Population estimates of black-tailed deer abundance and post-season ratios are unavailable for the 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 may harvest antlerless deer during general seasons. Certain GMUs targeted for deer population control also allow antlerless opportunities for modern firearm hunting under special permit drawings. Harvest estimates have remained relatively stable over the past ten years (Figure 2).

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. While hunter effort has declined steadily since 2010, the 2020 season saw a slight increase in the number of hunter days which could be attributed to the COVID-19 pandemic (Figure 3). The catch-per-unit effort (kills/hunter-day) remains very consistent each year, around the 10-year average (Figure 3).

Survival and Mortality

Common predator species in the South Cascade Mountains BDMZ include cougar, bobcat, black bear, and coyote. Currently, there are no documented gray wolf packs in the herd area (WDFW et al., 2022).

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 habitats, the annual buck survival rate is closer to 0.86 and mortalities are generally not the result of harvest (Bender et al., 2004).

In a sample of 38 GPS-collared black-tailed bucks from 2017-2021, the estimated annual survival was 0.42 (WDFW, unpublished data). 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 forests 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).

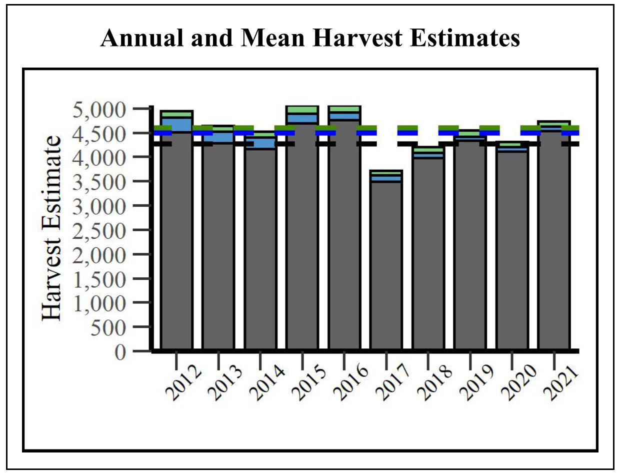

Figure 2. Harvest estimates and 10-yr mean (dashed lines) for General State Harvest (gray), General State + Permit State Harvest (blue), and General + Permit + Reported Tribal Harvest (green) in the South Cascade Mountains BDMZ, 2012-2021.

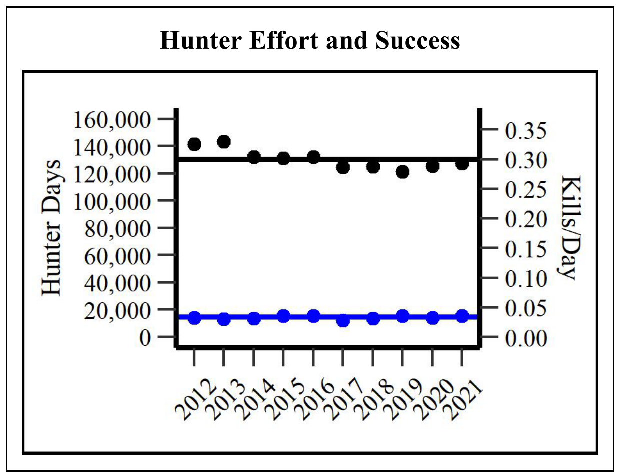

Figure 3. General season estimates and 10-yr mean for hunter days (black) and catch-per-unit-effort (blue) in the South Cascade Mountains BDMZ, 2012-2021.

Habitat

The South Cascade Mountains BDMZ is roughly divided into three primary ownership types: U.S. Forest Service-managed lands in the higher elevations to the east; private industrial timberlands and State (DNR) managed forestlands; and urban, suburban, rural, and agricultural lands found in the valleys and lower elevations. Increasing urbanization in the lower elevation portions of the South Cascade Mountains BDMZ has resulted in the 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 forests. Industrial timber management practices benefit deer by increasing the quantity of early seral habitats and forage species preferred by black-tailed deer including trailing blackberry, fireweed, salmonberry, red huckleberry, and vine maple. While beneficial to deer, management practices are not conducted to increase or improve habitat purposefully. Additionally, intensive forest management practices, including the planting of dense stands of fast-growing conifer seedlings and the application of herbicides during the re-establishment of timber stands 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 around 14-20 years (Ulappa, 2020), far earlier than would occur in a naturally regenerated stand.

The magnitude of these 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 these varying factors is that the best quality and most quantity of favorable forage occurs approximately 3 to 14 years after timber harvest, whether herbicide treatments are applied or not. However, the differences between available, favorable forage in that period for treated and untreated stands can still be substantial. The nuances of how forage availability is influenced by forest stand age and the application of herbicides are complex and in-depth research on the subject can be found by reviewing Ulappa (2015 & 2020) and Geary et al. (2012).

In contrast, very limited timber harvest on federal forests in the last three decades has led to more even-aged, closed canopy forests than were historically found in the Pacific Northwest. As a result, these forests have lower abundance of forage species important to deer. Generally, they support fewer deer than the early-seral forests found on private industrial and State managed timberlands.

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 increased in the South Cascades Mountains BDMZ with higher human populations. WDFW 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 agricultural crops using non-lethal and lethal methods (Table 1).

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 to commercial agriculture production over the past year has occurred in organic produce farms, wine grapes, hay, grains, and ornamental flower nurseries.

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. In some circumstances, Master Hunters are deployed to hunt outside established hunting seasons to address damage issues directly.

GMU	DPCAs	Deer Removed
654	2	2
652	2	2
667	1	1
564	6	0
574	2	2
578	2	0
Total	**15**	**7**

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 has been exploring new ways to generate estimates of black-tailed deer abundance or population trends. In May 2017, biologists began deploying GPS collars on a sample of bucks distributed across western Washington. Monitoring these bucks provides information on buck survival, causes of mortality, vulnerability to harvest, and a detailed account of the area used by these collared bucks. This project has been discontinued because it was found to be too costly and time-consuming to capture an adequate number of bucks.

In 2019, WDFW initiated an effort to collect teeth of black-tailed deer from successful hunters in western Washington. A total of 473 teeth were collected in the first year of collection. Additional tooth collections occurred in 2020. By analyzing tooth cementum annuli (i.e., annual growth rings), researchers can determine the age of each deer. These results will allow WDFW to improve and refine deer management in western Washington by assessing the relationship between deer age and antler points and exploring an innovative technique to estimate black-tailed deer abundance.

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 ungulate forage and lack older or younger forests' diversity and forage resources. In recent years, the United States Forest Service (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 compared to the size of the landscape. Therefore, WDFW will continue to work with USFS to encourage more of this proactive management.

Fee-Only Hunting Access Restrictions

Since 2013, the largest industrial forestland owner within the South Cascades Zone has 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, primarily in GMUs 520, 524, 550, 556, 568, and 667. The ramifications of this limited access to deer hunting opportunities are difficult to quantify as the landowners don't own entire Game Management Units. Some hunters 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 remains similar in these GMUs before and after the change in recreational access opportunities. However, the number of hunters in these GMUs has decreased by approximately one-third across the six GMUs mentioned above.

Hair Loss Syndrome

"Hair loss syndrome" (HLS) in 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*). The regular 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 the loss of 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 "hair-slip syndrome" rates 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, and timing of birth; as well as afflictions including, but not limited to HLS.

Many HLS-affected individuals rebound in condition and health if they survive the winter. Ultimately, HLS is likely only one of several regular annual mortality factors acting synergistically in given local populations.

WDFW provides more information regarding hair loss syndrome at its Wildlife Diseases website: Hair-loss syndrome in deer.

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 federally managed lands and direct habitat loss to urbanization remain a concern. The progression towards limited, fee-based hunting access programs and HLS 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. Still, the Department continues to investigate new methods that might provide additional information about population status in the future.

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Willapa Hills Black-tailed Deer Management Zone

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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 to 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 obtained from mandatory hunter reporting by licensed state hunters and tribal harvest reports. 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 2021 Big Game Harvest Reports for Western Washington Treaty Tribes).

Hunting Seasons and Recreational Harvest

Estimates from harvest reports for the past decade indicate the harvest has generally been stable. 2017 was the lowest estimated harvest during the 2012-2021 timeframe (Figure 2). Last year (2021) saw a very slight decrease in hunter harvest compared to 2020, but it was higher than in both 2017 and 2018, and the total harvest in 2021 was close to the average since 2012.

Hunter's effort in 2021 was higher than the ten-year average and slightly below its highest point from 2012-2021 (Figure 3). The lowest point occurred in 2018, Kills/day (e.g., Catch per Unit Effort or CPUE) have been relatively stable since 2012 and peaked in 2016.

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. Limited permit opportunities are available for both antlerless deer and bucks throughout the Willapa Hills BDMZ.

Most units are open for any deer during archery seasons, and GMUs 506, 681, and 699 are limited to any buck during archery seasons.

Survival and Mortality

There are 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 the 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 to provide additional data on the survival and mortality of bucks and female deer and fawns within the BDMZ (see Research) is forthcoming.

Habitat

Most of forestland in the Willapa BDMZ is managed to maximize revenue from timber production. Both the privately-owned industrial forestlands and large portions 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 yearly 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 are 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 to reduce competitive plant growth during re-establishment. Ulappa (2015 & 2020) 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 three 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 forests typically occurs at around 14-20 years post-planting, which is far earlier than in most naturally regenerated stands. Once canopy closure occurs, forage availability decreases significantly. More naturally regenerated stands can continue to produce improved levels of forage through the first 30 years of growth. 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. WDFW Wildlife Conflict specialists work closely with producers by developing Damage Prevention Cooperative Agreements (DPCAs), which identify a plan to reduce the 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, including 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 2021-2022 was 24, with nine deer harvested from 41 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.

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. In addition, certified Master Hunters may be deployed to harvest animals outside of the regularly established hunting seasons.

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, 2021-22.

Game Management Unit	DPCA's	Permits Issued	Deer Removed
501	0	0	0
506	0	0	0
530	0	1	0
658	10	15	3
660	0	0	0
663	0	0	0
672	3	7	3
673	5	1	0
681	2	2	0
684	4	15	3
Sum	**24**	**41**	**9**

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 timberland, 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 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 five years. GPS collars were deployed on a sample of bucks distributed across western Washington with the objective of maintaining a sample of up to 50 bucks during each year of the 5-year study. Monitoring of these bucks was expected to provide information on buck survival, causes of mortality, and vulnerability to harvest. Additionally, these collars would automatically record a position fix every thirteen hours, providing a fairly detailed account of the area used by these collared bucks. To date, only two collared bucks were located within the Willapa Hills BDMZ. Those two animals were specifically located inside the Fall River GMU (672) and both were harvested during the 2019 hunting season. This project was canceled in 2020.

WDFW initiated an effort in 2019 to collect the teeth of black-tailed deer from successful hunters in western Washington. WDFW collected hundreds of tooth samples from successful black-tailed deer hunters during the 2019 and 2020 seasons. Hunters also reported the number of their buck's antler points with each tooth, and samples were sent to a laboratory for cementum annuli analysis to determine age. Generally, the number of antler points increases with age; however, a 3-year-old buck may still be a spike, and an 11-year-old buck could be a 2-point, while a yearling could have 4 points. On average, spikes were a year old, while a 2-point buck was three years of age, and a 3-point buck was four years of age. Four-point bucks were 4 ½ years on average, and 5-point bucks were five years old.

Management Concerns

Hunter Access

WDFW actively works with timber companies to maintain hunting access. The majority of lands that provide deer hunting opportunities in the Willapa Hills BDMZ are privately owned industrial timberlands. There's an increasing trend among the timber companies to restrict public access or require an access permit to hunt or recreate on their lands. The multitude of landowners with changing ownerships and rules regarding public access creates confusion and uncertainty among hunters trying to get afield.

Implementation of fee access programs appears to have 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. Access can 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, and 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"(HLS) in fawns as 46-74% from 1999-2001. They concluded that HLS was insignificant in increasing fawn winter mortality and called for future research to determine better the 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, the timing of birth, as well as afflictions including 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 Diseases website: Hair-loss syndrome in deer.

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

Management Conclusions

Black-tailed deer populations in the Willapa Hills BDMZ appear to be within the management objectives 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.

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Elk

Blue Mountains Elk Herd

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MARK VEKASY, Wildlife Biologist

Introduction

The Blue Mountains elk herd area is 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.

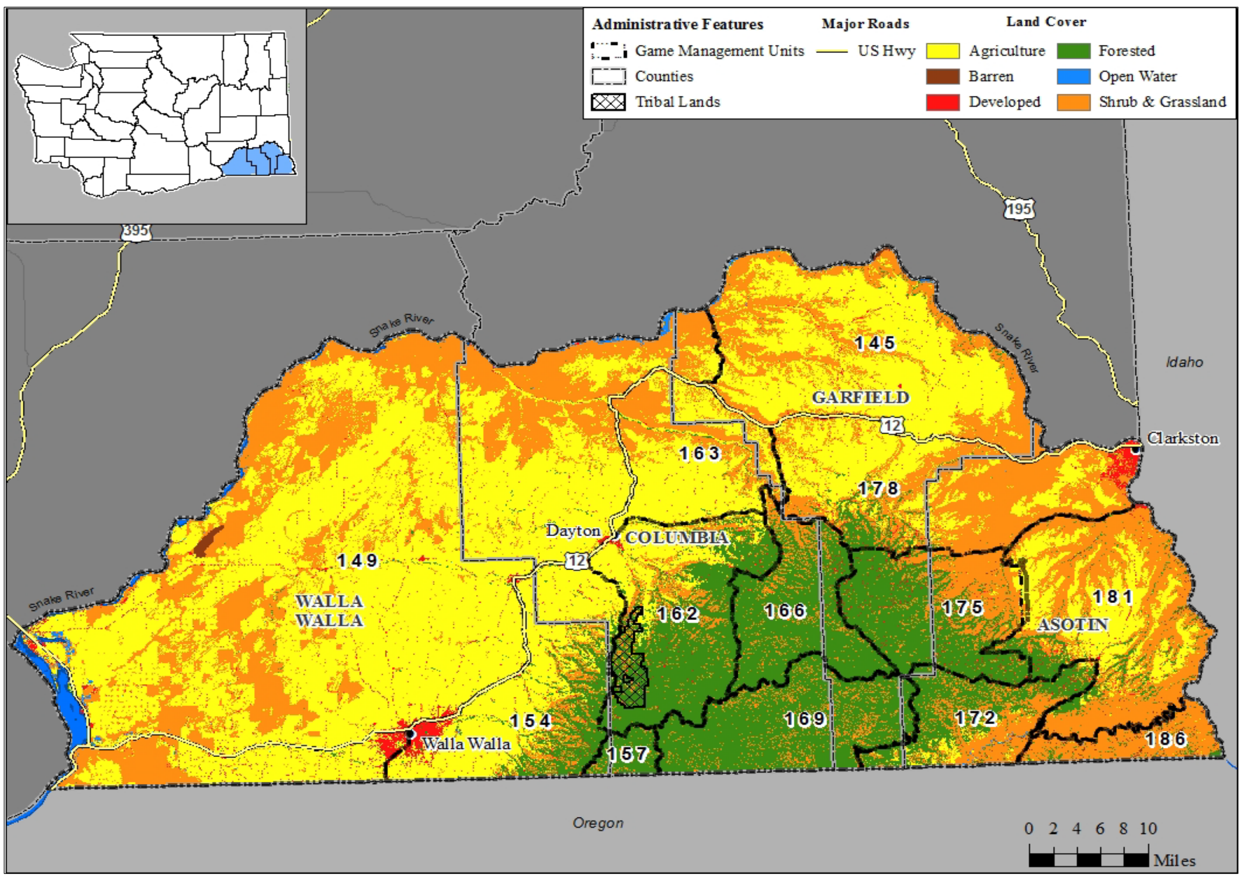

Figure 1. Dominant land use cover types within the 13 game management units that comprise the Blue Mountains elk herd area.

Management Guidelines and Objectives

The Department finalized the Blue Mountains Elk Herd Plan in 2020, 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 at the end of winter 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 late winter 2022, the Department estimated total elk abundance to be 3,901 elk (90% CI 3,843-4,027), which is below the management objective of 5,500 elk. Abundance estimates indicate the Blue Mountains elk herd was within objective from 2009 through 2017, when a severe winter was predominantly responsible for triggering the decline (Figure 2). The estimated bull:cow ratio in 2022 was 20 bulls:100 cows, which is below the management objective of 22–28 bulls:100 cows (Figure 3). The estimated calf:cow ratio in 2022 was 17 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). WDFW conducted no aerial surveys in the Spring of 2018.

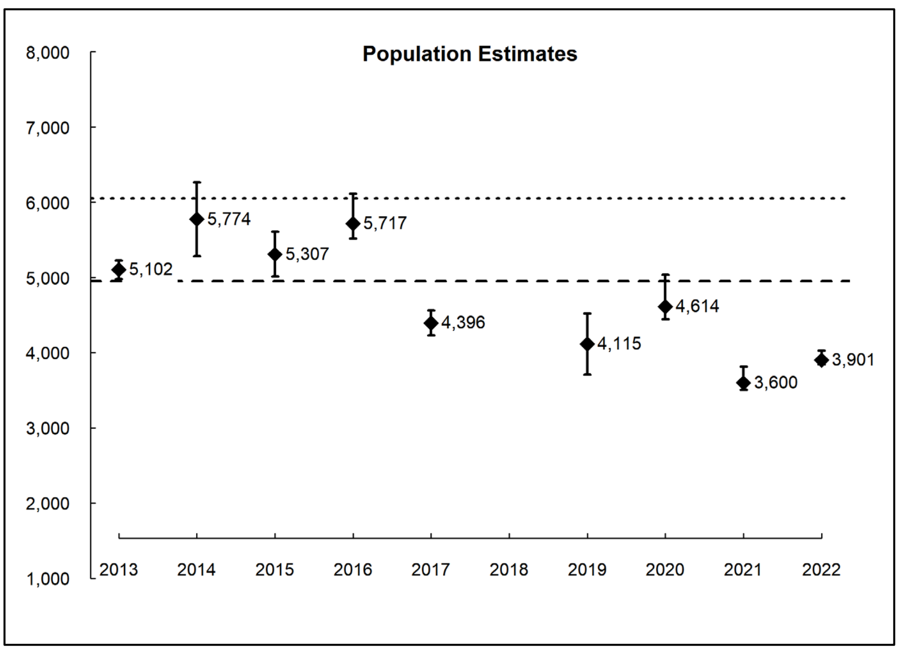

Figure 2. Sightability corrected estimates of total elk abundance with associated 90% confidence intervals in the Blue Mountains elk herd area, 2013-2022. The dashed lines represent management objectives for total elk abundance (4,950–6,050 elk).

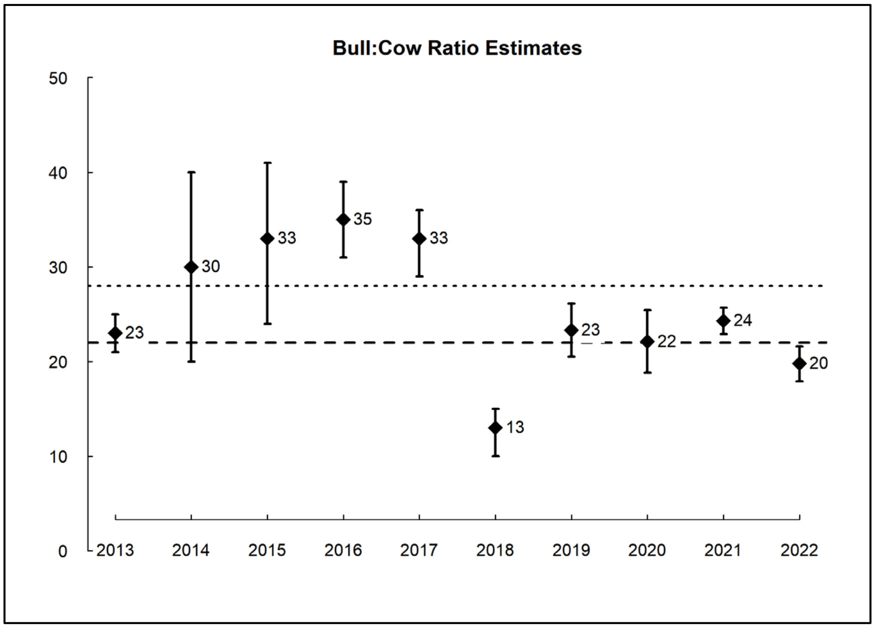

Figure 3. Estimates and associated 90% confidence intervals of post-hunt bull:cow ratios in the Blue Mountains elk herd area, spring 2013-2022. The dashed lines represent the objective range of 22-28 bulls:100 cows. The 2018 data are based on ground sampling of historic elk winter ranges and are not thought to accurately reflect the true population ratios due to low observability of bulls from the ground.

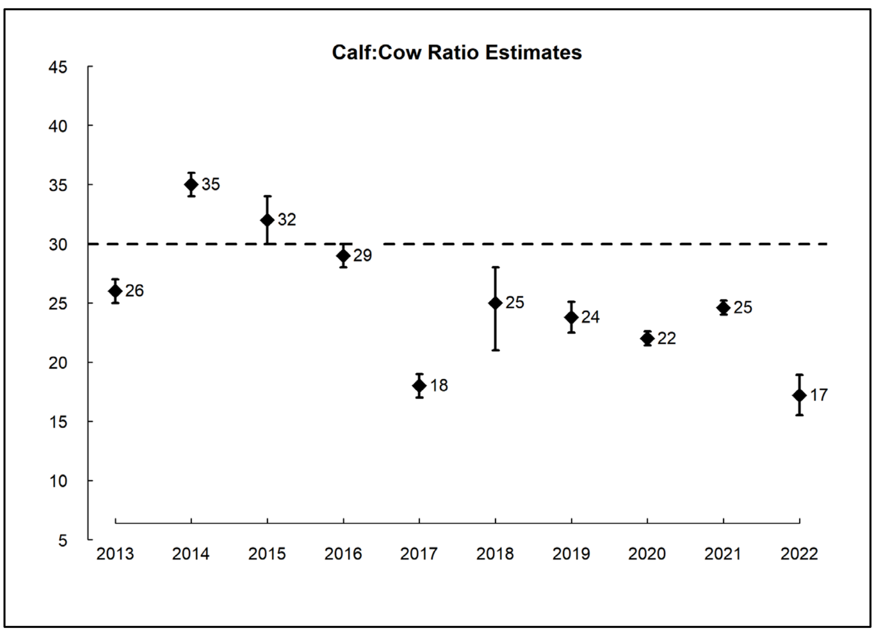

Figure 4. Estimates and associated 90% confidence intervals of post-hunt calf:cow ratios in the Blue Mountains elk herd area, spring 2013-2022. The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth. The 2018 survey data are based on ground sampling of historic elk winter ranges.

Hunting Seasons and Recreational Harvest

Estimates of total harvest have averaged 348 elk from 2010–2019 and were relatively stable from 2010–2015 (Figure 5). The Department restricts general season bull harvest to spikes and offers opportunities to harvest branch-antlered bulls under special permits in all GMUs. Consequently, most antlered harvest consists of spikes being harvested during general seasons (Figure 6). The Department generally focuses most opportunities to harvest antlerless elk in areas associated with private land to help alleviate agricultural damage, and most of those opportunities occur during special permit seasons (Figure 7). Estimates of hunter effort during general seasons have declined since 2017 (Figure 8), while estimates of Catch Per Unit Effort (CPUE) have varied (Figure 9).

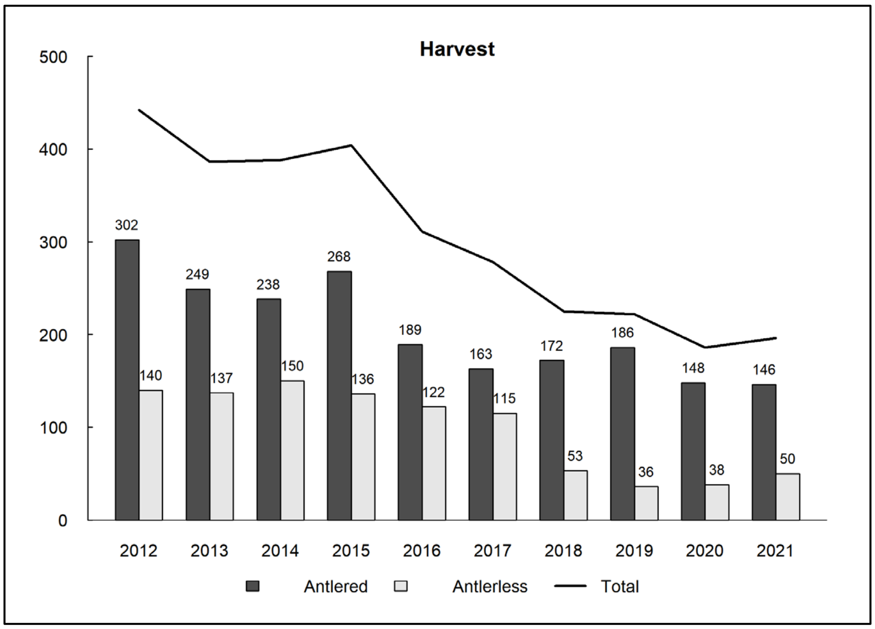

Figure 5. Estimated number of antlered and antlerless elk harvested in the Blue Mountains elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department, 2012-2021. Estimates do not include elk harvested in association with damage permits (see Human-Wildlife Interaction below). Estimates also do not include harvest that occurred during established Tribal seasons because that data is not collected.

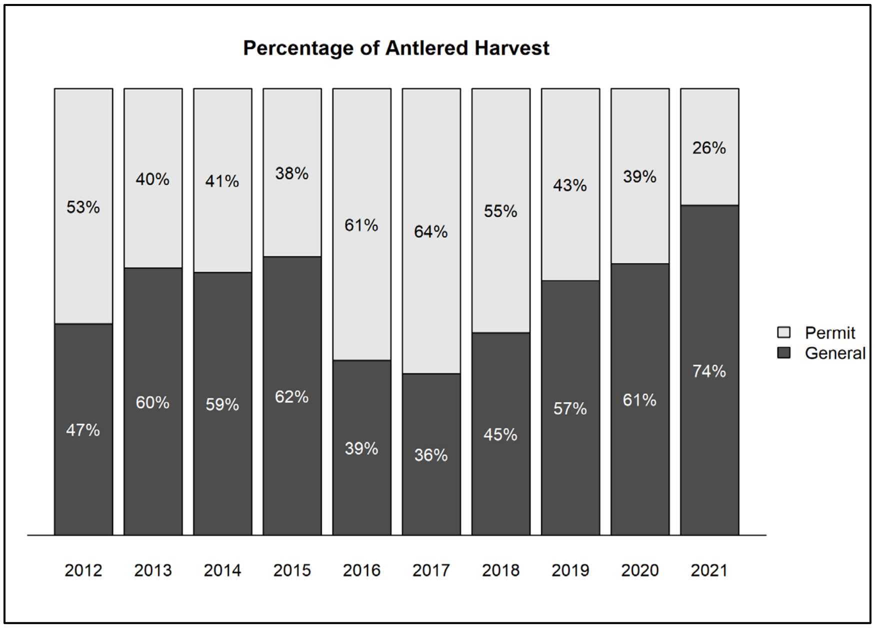

Figure 6. Estimated percentage of recreational antlered harvest in the Blue Mountains elk herd area that occurred during general and permit seasons, 2012-2021.

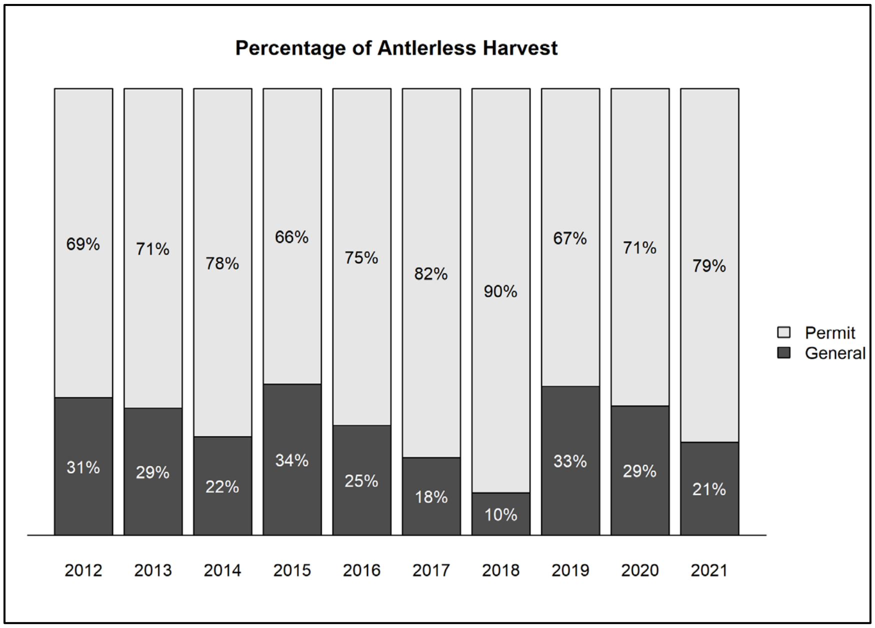

Figure 7. Estimated percentage of recreational antlerless harvest in the Blue Mountains elk herd area occurring during general and permit seasons, 2012-2021.

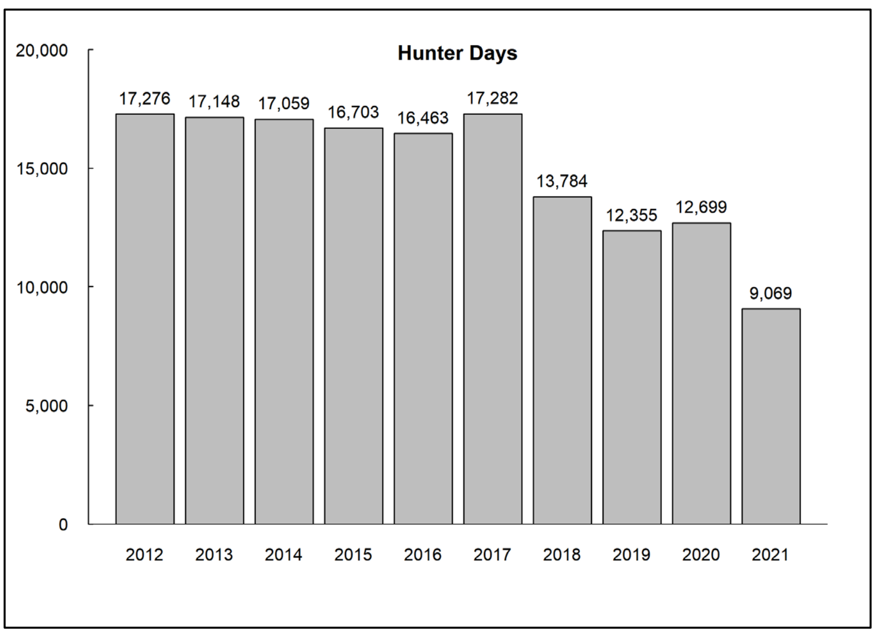

Figure 8. Estimated number of days hunters spent pursuing elk in the Blue Mountains elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

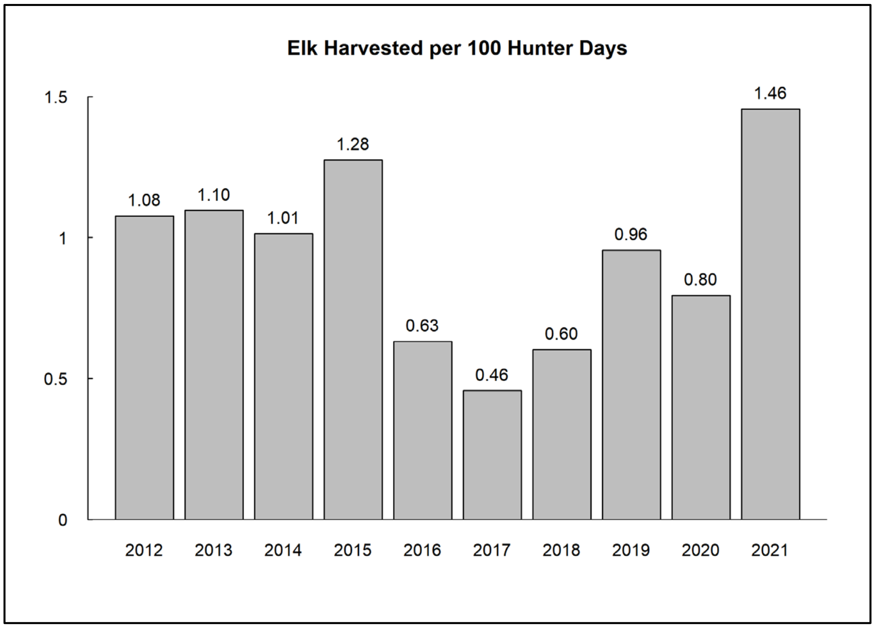

Figure 9. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the Blue Mountains elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

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 four confirmed wolf packs within the Blue Mountains elk herd area (WDFW et al., 2022).

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

Human-Wildlife Interaction

While actual elk damage claims have historically been low, complaints from farmers are common, and elk damage continues to be a problem in some units. WDFW addresses damage by issuing landowner depredation permits and implementing non-lethal control measures. The most significant 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 limiting harvest to antlerless elk.

Damage issues in GMU 181 have remained high in the Cloverland area. Periodically, large numbers of elk move into the western portion of the GMU (Couse), with this trend continuing over the past four years. During the reporting period, 34 antlerless elk were harvested by Damage Prevention Cooperative Agreement (DPCA) or Kill permit holders in the Blue Mountains, 16 of which were killed south of Mill Creek in GMU 154, where elk frequently move between Oregon and Washington. This approach to reducing elk-caused damage to private lands is currently accomplishing its goal in most of the herd range, resulting in more targeted hunts that alter elk distribution at a smaller scale.

Research

Beginning in May 2021, an elk calf mortality project began in the Blue Mountains. One hundred twenty-five neonate calves were captured and fitted with satellite/GPS expandable collars in 2021, and 102 were captured in 2022. This effort aims to estimate calf survival and determine causes of mortality, with poor calf recruitment likely being a limiting factor in recovering this elk population to management objectives. However, this project does not have a timeframe associated with it but is currently planned to continue through 2023.

Management Concerns

The number of elk estimated to be within the Blue Mountains herd area is 22% below the lower range of our population objective of 4,950 elk and 29% below our point objective of 5,500 elk. The decline in this population has occurred in the last six years and is likely attributed to severe winter conditions and poor recruitment resulting from high mortality associated with cougar predation. When the calf monitoring effort identified a problem, WDFW considered several management actions for implementation but implemented only one in the summer of 2022. A second cougar tag is now available for hunters in the Blue Mountains, but the Harvest Guideline remains in place.

Road densities in some portions of the Blue Mountains elk herd area are above the recommended levels. They can potentially reduce the use of important summer ranges because of human disturbance. The United States Forest Service (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 ranges continue 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 winter 2018/2019 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.

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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 six GMUs: 249 (Alpine), 251 (Mission), 328 (Naneum), 329 (Quilomene), 330 (West Bar), 334 (Ellensburg), and 335 (Teanaway) (Figure 1).

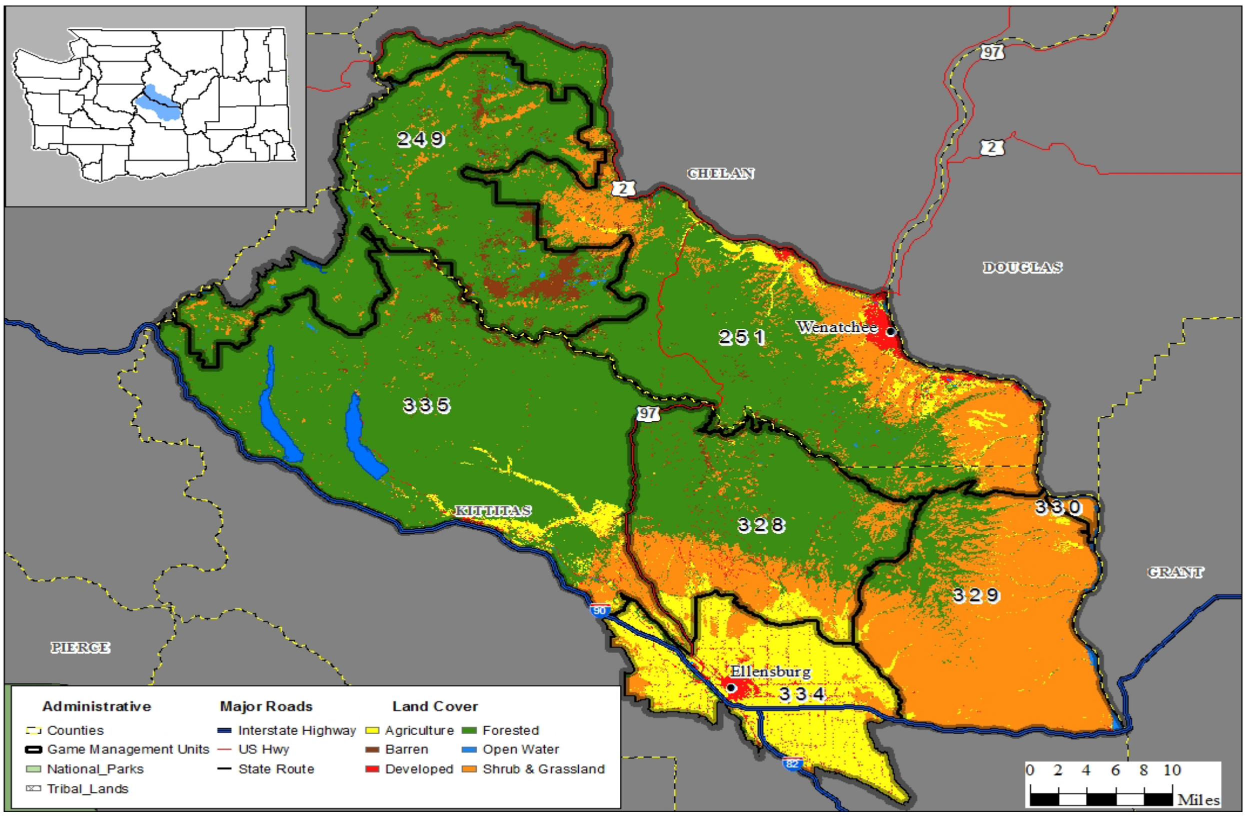

Figure 1. Dominant land use cover types within the 6 game management units that comprise the Colockum elk herd area.

Management Guidelines and Objectives

The Department's current objective is to maintain elk abundance in the surveyed winter range post-winter at 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 the Colockum elk herd by conducting post-winter aerial composition surveys 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 last Department conducted a post-hunt composition survey was in March 2021 and estimated total elk abundance in the core winter range to be 4,165 elk (90% CI = 4,128–4,203), which is slightly below the management objective. Estimates of total elk abundance steadily increased from 2006–2015, declined through 2020, and increased slightly last year (Figure 2). The initial declines were the result of recent high antlerless harvests, an extended drought in 2015, and severe winter conditions during the winters of 2015-2016 and 2016-2017. Antlerless harvest (Figure 5) has now been reduced to reverse the population decline.

The Department estimated post-hunt calf:cow and bull:cow ratios in March 2020 to be 29:100 and 10:100, respectively (Figures 3, 4). The estimated bull population is below objective. The low calf recruitment has resulted in low spike-bull recruitment through hunting season. The total bull mortality is likely exceeding recruitment. There is no new information for 2022.

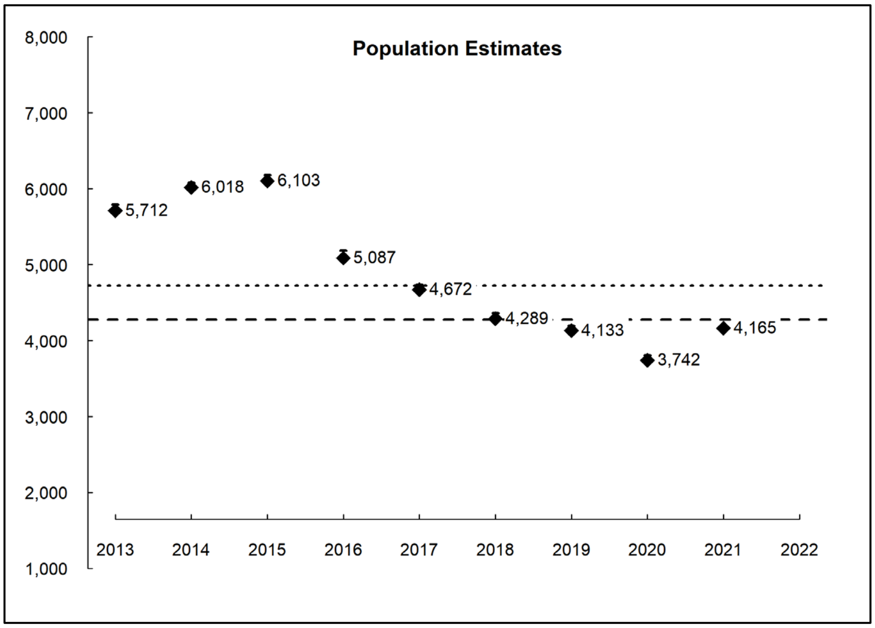

Figure 2. Sightability corrected estimates of total elk abundance with associated 90% confidence intervals in the Colockum elk herd area, spring 2013-2022. The dashed lines represent management objectives for total elk abundance (4,275–4,725 elk).

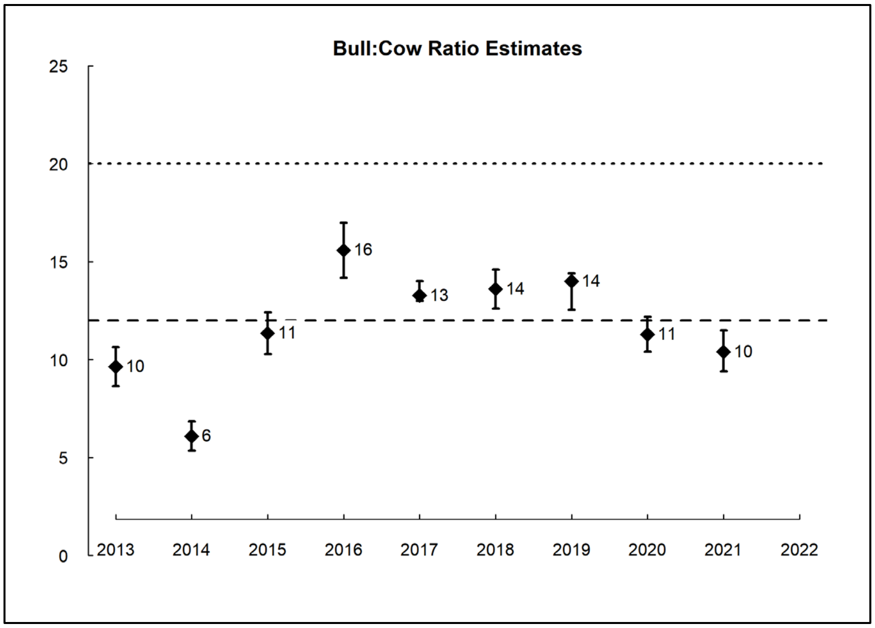

Figure 3. Estimates and associated 90% confidence intervals of post-hunt bull:cow ratios in the Colockum elk herd area, spring 2013-2022. The dashed lines represent the objective range of 12-20 bulls:100 cows.

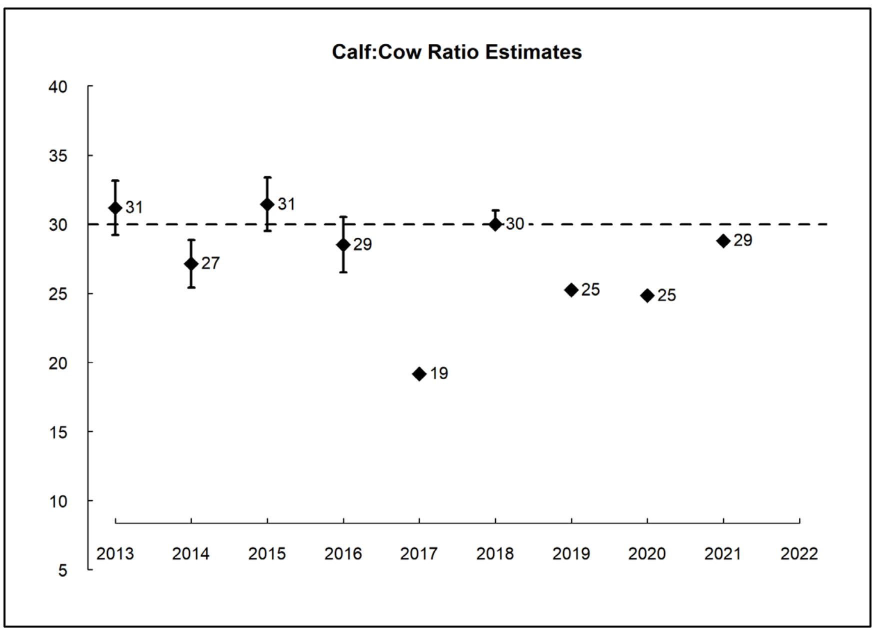

Figure 4. Estimates and associated 90% confidence intervals of post-hunt calf:cow ratios in the Colockum elk herd area, spring 2013-2022. The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth.

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. Antlerless harvest steadily increased before peaking in 2015 (Figure 5). As the population approached the objective (Figure 2), the Department subsequently reduced those opportunities, and antlerless harvest declined accordingly, 2016–2021 (Figure 5). Figure 5 does not include antlerless harvest from damage permits issued to landowners. Proportions of antlered and antlerless harvest during general and special permit seasons are shown in Figures 6 and 7. Hunter's effort declined in 2010, likely in response to the Department implementing “true-spike” restrictions in 2009 but increased from 2012–2018 as opportunities to harvest antlerless elk were increased (Figure 8). Effort has decreased since 2018 with reduced antlerless opportunities, and Hunter kills per 100 days of effort are shown in Figure 9.

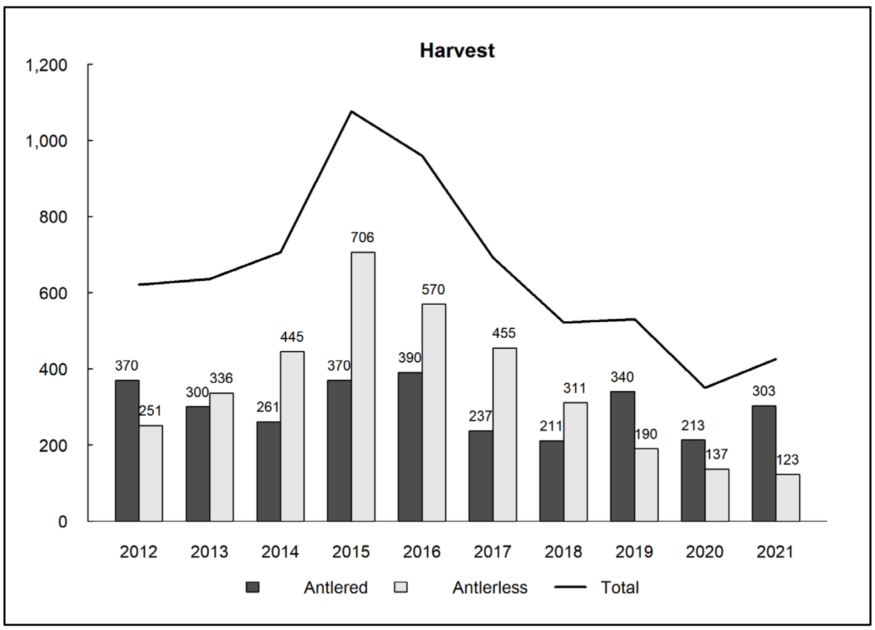

Figure 5. Estimated number of antlered and antlerless elk harvested in the Colockum elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department, 2012-2021. Estimates do not include elk harvested in association with damage permits (see Human-Wildlife Interaction below). Estimates also do not include harvest that occurred during Tribal seasons because those data are currently not provided.

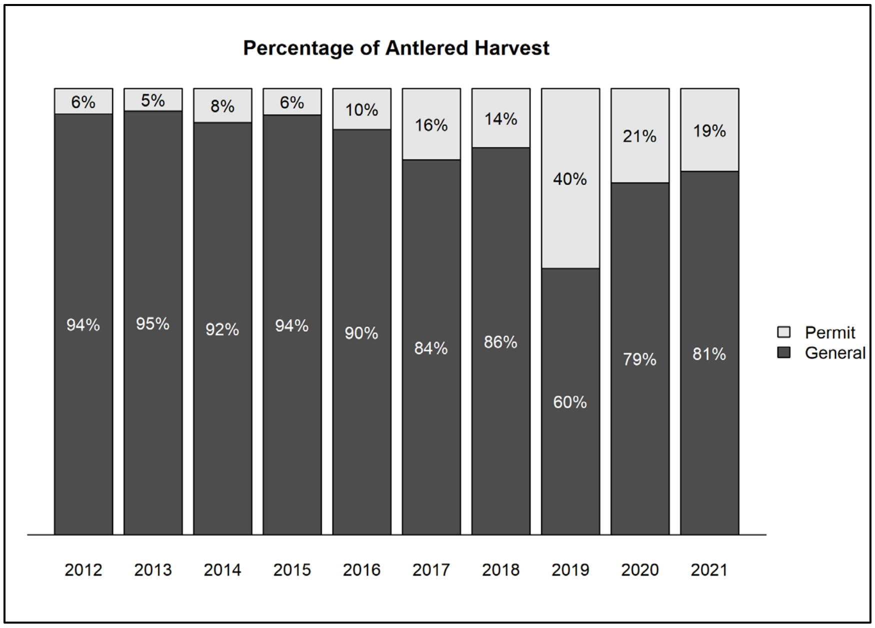

Figure 6. Estimated percentage of recreational antlered harvest in the Colockum elk herd area that occurred during general and permit seasons, 2012-2021.

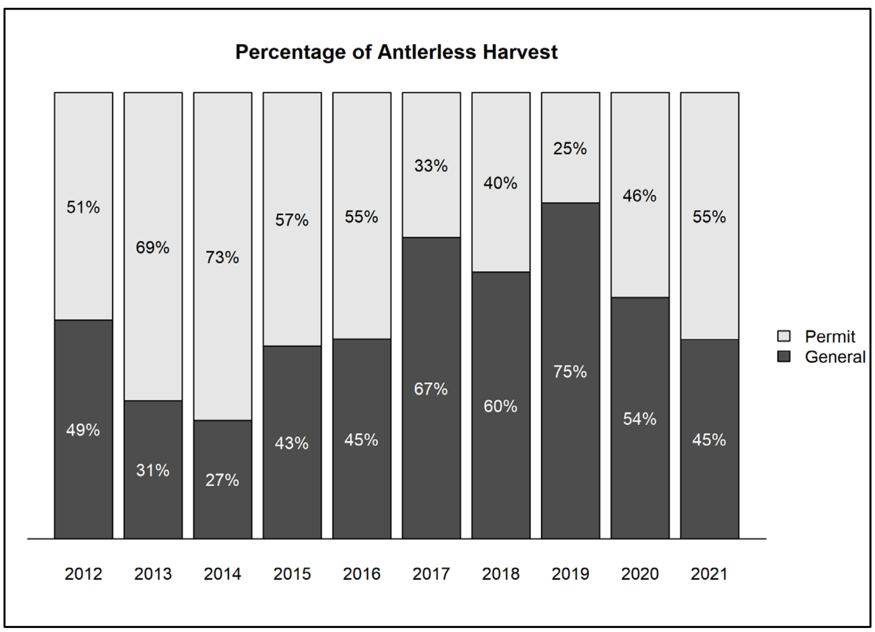

Figure 7. Estimated percentage of recreational antlerless harvest in the Colockum elk herd area that occurred during general and permit seasons, 2012-2021.

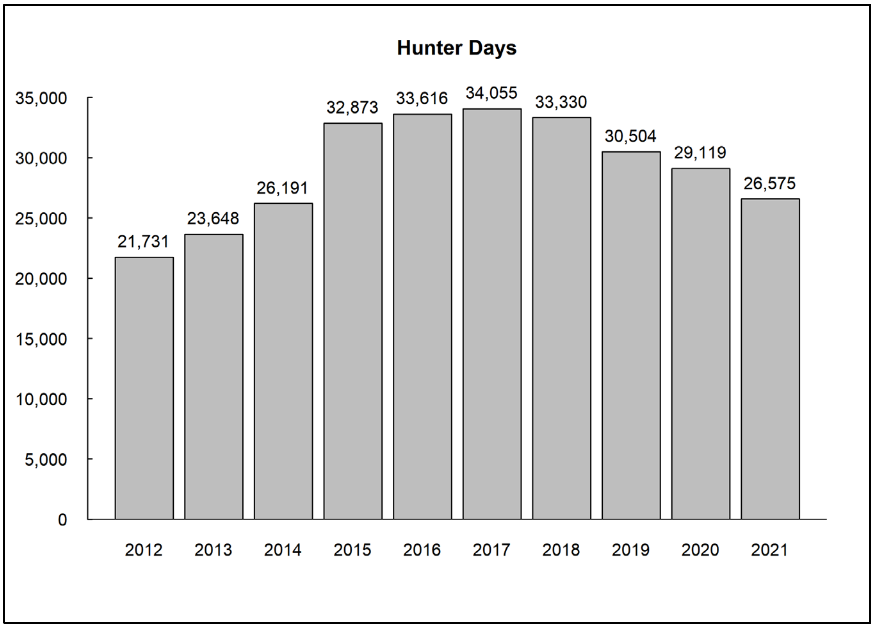

Figure 8. Estimated number of days hunters spent pursuing elk in the Colockum elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

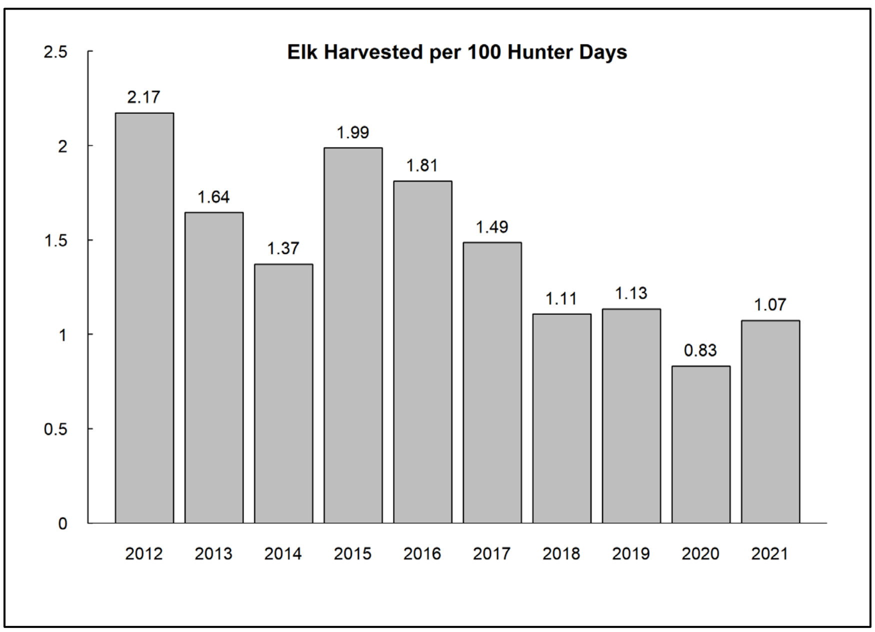

Figure 9. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the Colockum elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

Survival and Mortality

Common elk predators 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, two confirmed wolf packs were within the Colockum elk herd area (WDFW et al., 2021).

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 ages 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 from 261 to 706 harvested elk from 2014 to 2015, but the population decreased by >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 and the following severe winter, which likely impacted body fat reserves and possibly 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 the summer range, fires increase forage quantity and quality but reduce security in a heavily roaded landscape. Fires typically convert vegetation to grass on arid portions of the winter range (cheatgrass on south slopes and disturbed areas). This likely has a negative impact on elk because of reduced plant diversity and the poor forage quality of invasive plants.

Human-Wildlife Interaction

The Colockum herd is not fenced from private lands, and damage is managed by hunting, damage permits, and hazing. The boundaries of the hunts are adjusted frequently, depending on where damage occurs. In 2004, WDFW extended the damage permit season to August 1st – February 28th. In recent years, the general damage season closed on 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 2021, 78 antlerless elk were reported harvested via damage tags issued to landowners. Another 60 antlerless elk were harvested during the Master hunter open damage general season.

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 Washington 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 or 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 is 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, consistent with historic levels, the last five 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. The Department has reduced permit opportunities for modern firearm and muzzleloader hunters to harvest antlerless elk and remove the general archery antlerless season to prevent further declines. Archery antlerless harvest was restricted to permit only, beginning in 2020. The targeted antlerless harvest may stop the decline but will not likely increase the population unless there is a significant increase in calf recruitment.

Agricultural damage is a concern for some landowners in the Colockum elk herd area. Many factors cause elk to move into areas where they conflict with private landowners. Cultivated lands and irrigated pastures are attractive foraging areas for elk. Human disturbance can be high on public lands, especially during late winter. More recently, elk have become concentrated in areas like the Coffin Game Reserve when human disturbance is high. In addition, the reserve offers security for elk on a landscape where secure areas are minimal.

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 the borders of 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. To date, WDFW has not been able to obtain a full landowner agreement. WDFW is working with Kittitas Reclamation District (KRD) to develop a fence that will be along an irrigation canal as part of an upgrade to the canal.

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. From 2016-2019, the estimated bull:cow ratio was within objectives for the traditional winter range that is surveyed. The decrease from 2020-2021 to 10 bulls per 100 cows is concerning. It is not known if the decrease is due to portions of the mature bull subpopulation wintering outside the surveyed portion of the winter range or due to high mortality/low recruitment. New techniques/methods may need to be adopted to estimate the total bull subpopulation better.

Management Conclusions

The Colockum herd was below the desired total population objective. Steps have been taken to slow the decline and stabilize the herd. The increased damage harvest in 2021 was a setback. Antlerless harvest restrictions will likely need to be maintained or increased to get the population back to objectives. The Colockum herd has fallen below bull:cow ratio objectives on the surveyed portion of the winter range. True-spike general season hunting has reduced yearling bull mortality, but adult bull mortality may increase while recruitment decreases. Adjustment of the current survey structure is needed to estimate better the full complement of adult bulls in the population.

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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: 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).

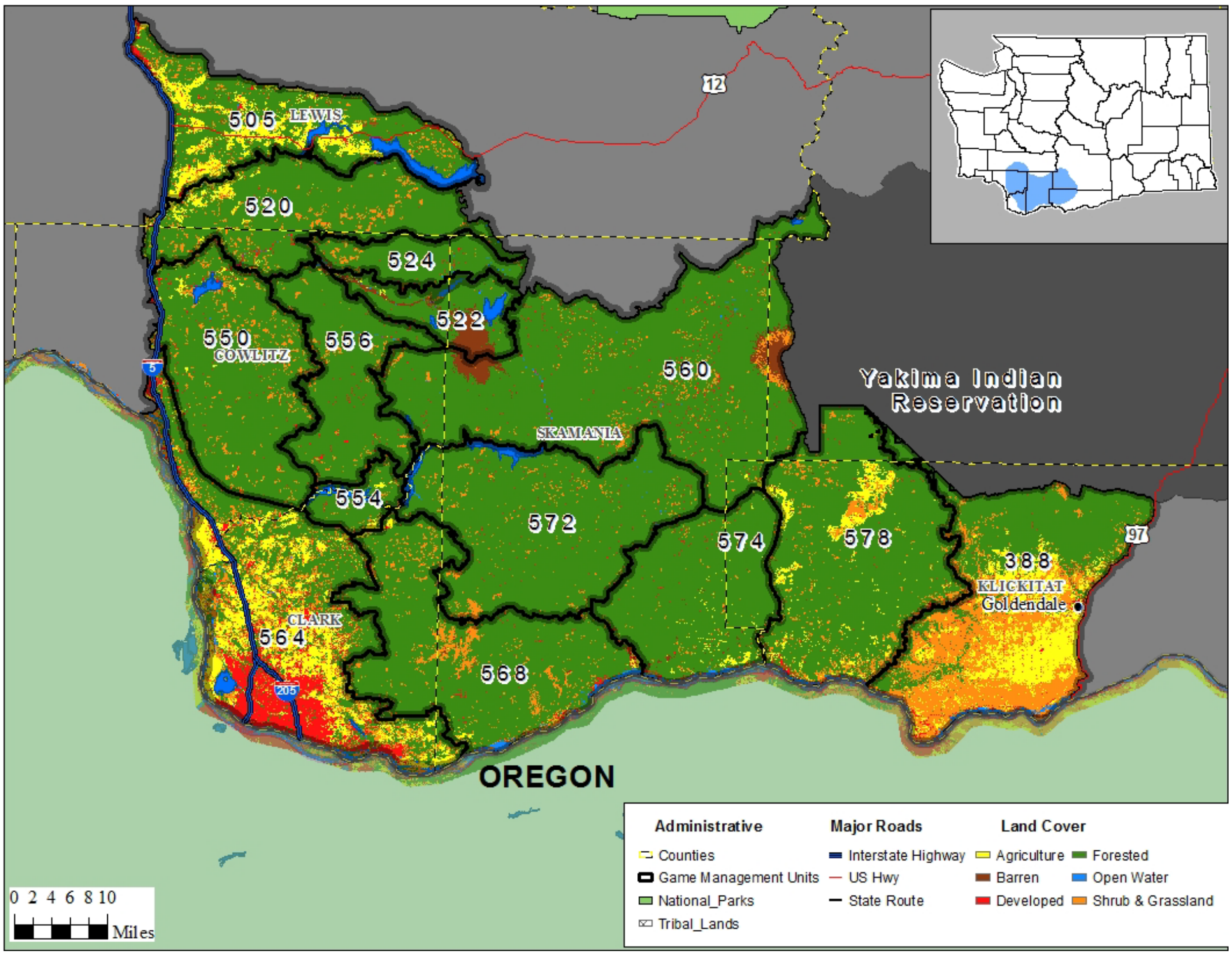

Figure 1. Dominant land use cover types within the 14 game management units that comprise the Mount St. Helens elk herd area.

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 to reduce 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 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 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 trends 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). Unfortunately, the COVID-19 pandemic and associated restrictions on work activities did not allow the survey to occur in 2020 or 2021. Restrictions were relaxed, and biologists completed the survey in March 2022. During this most recent effort, the Department estimated total elk abundance within the core herd area to be 1,522 elk (95% CI 1,475-1,651). 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 2022, the Department estimated post-hunt bull:cow and calf:cow ratios to be 33:100 and 34:100, respectively. Bull:cow increased since 2010 during the period of purposeful herd reduction and are well above management objective (Figure 3). Calf:cow have ranged from 25-41:100 over the past ten years (Figure 4).

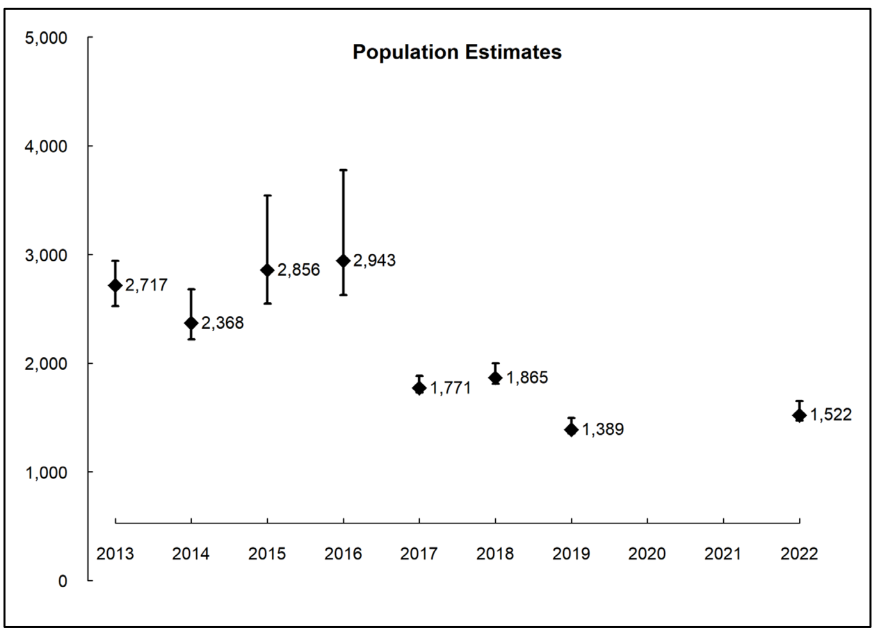

Figure 2. Sightability corrected estimates of total elk abundance with associated 95% confidence intervals in the core range of the Mount St. Helens elk herd area (GMUs 520, 522, 524, 550, 556), spring 2013-2022. WDFW did not conduct population surveys in spring 2020 and 2021.

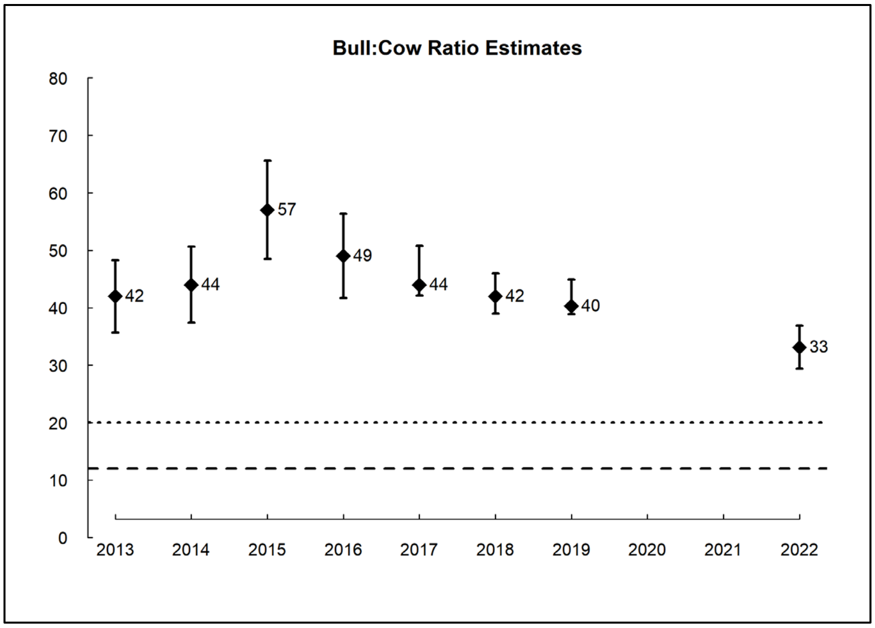

Figure 3. Estimates and associated 95% confidence intervals of post-hunt bull:cow in the core range of the Mount St. Helens elk herd area (GMUs 520, 522, 524, 550, 556), spring 2013-2022. The dashed lines represent the objective range of 12-20 bulls:100 cows. WDFW did not conduct population surveys in spring 2020 and 2021.

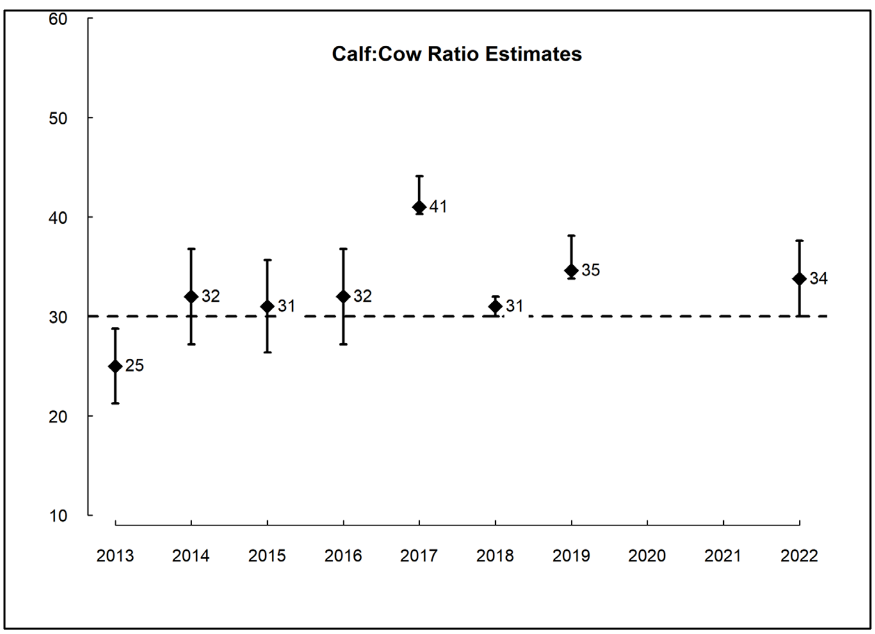

Figure 4. Estimates and associated 95% confidence intervals of post-hunt calf:cow in the core range of the Mount St. Helens elk herd area (GMUs 520, 522, 524, 550, 556), spring 2013-2022. The dashed line represents a calf:cow of 30 calves:100 cows that should promote herd stability or growth. WDFW did not conduct population surveys in spring 2020 and 2021.

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 this review, the Department restricted all elk harvest in GMUs 522 and 556 to permit-only opportunities. In addition, the Department restricted elk harvest in GMU 524 to special permits 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 and special permit seasons averaged 1,162 elk during 2012-2021 and have steadily declined during these ten years (Figure 5). Harvest has declined precipitously since the Department reduced opportunities to harvest antlerless elk in 2013 (Figure 5).

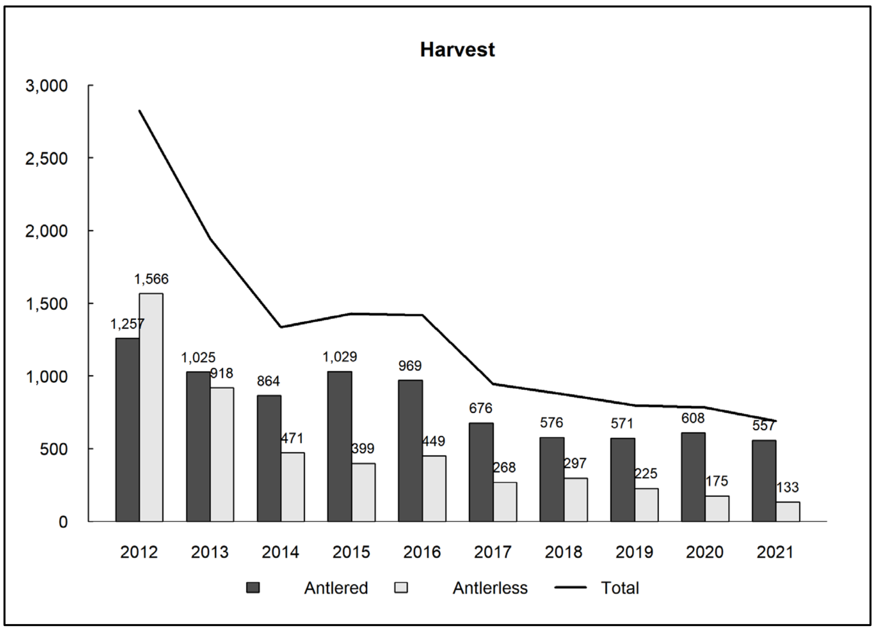

Figure 5. Estimated number of antlered and antlerless elk harvested in the Mount St. Helens elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department and during established Tribal seasons, 2012-2021. Estimates of Tribal harvest were derived 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).

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). Antlerless elk harvest occurs during a mix of general and permit-only seasons. Opportunities to harvest antlerless elk during general seasons occur primarily 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 reported tribal hunting seasons are minimal in the Mount St. Helens herd area, totaling just eight antlered and one antlerless elk during 2012-2021.

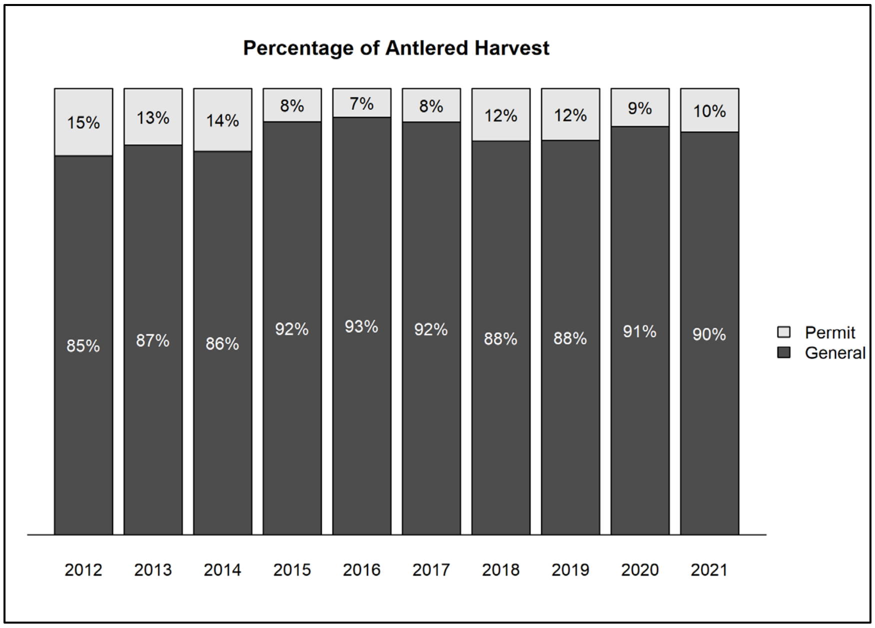

Figure 6. Estimated percentage of recreational antlered harvest in the Mount St. Helens elk herd area that occurred during general and permit seasons, 2012-2021. Harvest during established tribal seasons accounted for <1% of the antlered harvest and is not reported here.

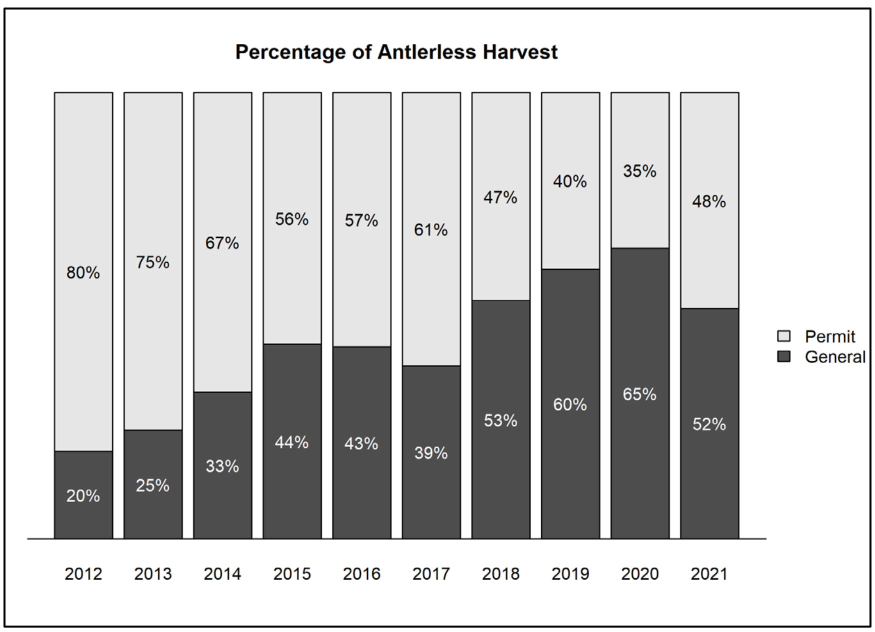

Figure 7. Estimated percentage of recreational antlerless harvest in the Mount St. Helens elk herd area that occurred during general and permit season, 2012-2021. Harvest during established tribal seasons accounted for <1% of the antlerless harvest and is not reported here.

Hunter effort within the Mount St. Helens herd area has steadily declined over the past ten years but did increase slightly during 2020 (Figure 8). Similarly, catch per unit effort (CPUE) has declined during 2012-2021 (Figure 9).

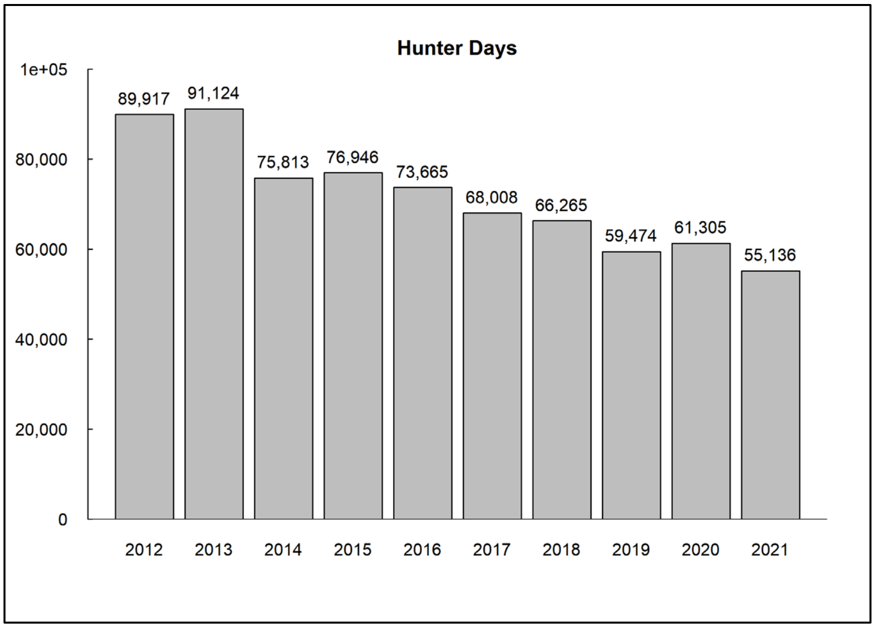

Figure 8. Estimated number of days hunters spent pursuing elk in the Mount St. Helens elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

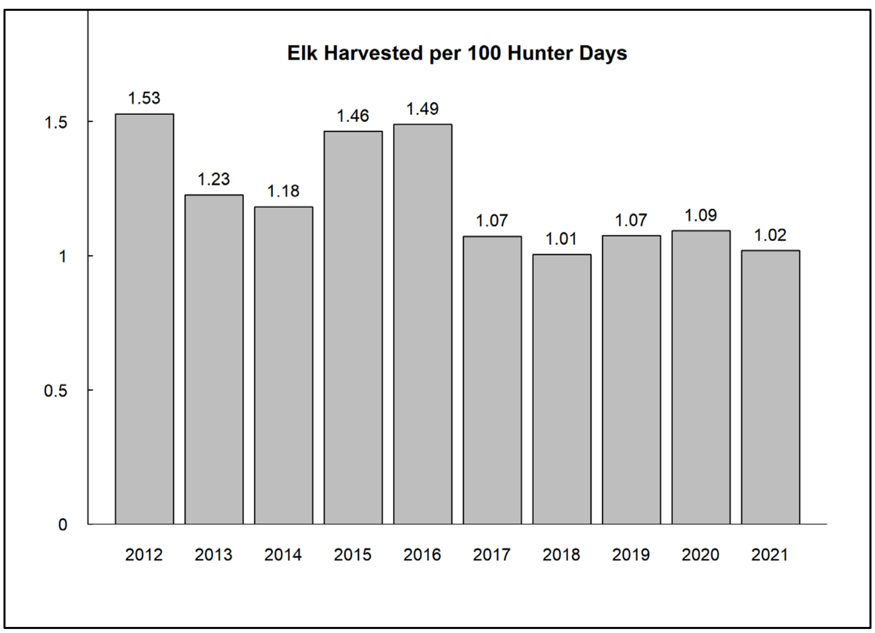

Figure 9. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the Mount St. Helens elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

Survival and Mortality

Common predators 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., 2022).

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). From 1999-2019, the Department conducted an annual winter elk mortality survey on the Mount St. Helens Wildlife Area and documented the number of elk carcasses detected. During that time, the number of elk carcasses detected varied annually, averaging 36 per year, and was above the 21-year average on seven separate occasions, most recently in 2014.

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 2019 and involved capturing, collaring, and monitoring 178 individual elk. The Department is in the process of analyzing this information.

The Department (McCorquodale et al., 2014) monitored the survival of branch-antlered bulls and adult female elk from 2009–2013. However, it did not attempt to account for elk mortalities by a cause beyond distinguishing between hunting-related and natural causes (e.g., predation, disease, winter mortality, etc. combined). The 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. The 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

Most of the landscape comprising the Mount St. Helens elk herd area is a roughly split of private industrial forestlands and U.S. Forest Service (USFS) managed lands. Smaller portions of the herd area are comprised of State Department of Natural Resources (DNR) managed forestlands, agricultural areas, urban/suburban lands, small forestland ownerships, and WDFW-managed lands.

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 forests. 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 increase or improve elk habitat purposefully. Additionally, intensive forest management practices, including planting dense stands of fast-growing conifer seedlings and applying herbicides during the 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 number 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. Site-specific types of post-timber harvest treatments, plant compositions, and the number of years since timber harvest influence the magnitude of those effects. A commonality among these varying factors is that the best quality and most quantity of favorable forage occurs approximately three to 14 years after timber harvest, whether herbicide treatments are applied or not. However, the differences between available, favorable forage in that time for treated and untreated stands can still be substantial. A full discussion of the complexity of these habitat interactions is beyond this report's scope. Please see 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; and planting trees and shrubs in upland areas and along the banks of the North Fork Toutle River to reduce bank erosion and re-establish tree cover.

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; establishing 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 16,000 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), 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. These authorizations to lethally remove elk usually require the landowner to allow public hunting on their property. In addition, Wildlife Conflict Specialists negotiate the amount of lethal elk removal and public access on a case-by-case basis with each landowner. Collectively, these hunts are designed to decrease the number of elk causing damage and 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 a historic winter range for elk occupying the southern Cascade mountains. Over the course of many years, the aggressive use of landowner kill permits and some non-lethal deterrents have failed to reduce this conflict. In order to help with this conflict, the Department implemented a liberalized late muzzleloader season in GMU 578 starting in 2018. This general season opportunity resulted in more harvest than anticipated, so it was replaced with a limited permit opportunity for antlerless elk starting in the 2021 hunting season.

Legislative funding during the 2021-23 biennium provided WDFW with cost-share funds for deer/elk fencing to protect agricultural crops. This funding allowed WDFW Conflict Specialists to work with two different producers in GMU 574, one producer in GMU 578, and three producers in GMU 564 to successfully construct fence projects in 2022 on their respective properties. As a condition of their individual cost-share agreements, producers who enter into these agreements are ineligible to file crop damage claims in the future. Thus, none of the producers who received cost-share funding were enrolled in DPCAs in 2022-2023. Furthermore, the fencing projects eliminated elk and deer damage to crops on these farms.

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 2021-22. Collectively, these hunts are designed to decrease the number of elk causing damage and to haze elk from the area.

Table 1. Number of DPCA'S (Damage Prevention Cooperative Agreements), Permits to lethally remove elk causing damage to agricultural crops, and resulting number of elk removed, Mt. St. Helens elk herd, 2021-22.

GMU	DPCAs	Elk Removed
505	6	3
520	3	3
554	1	0
568	2	0
574	2	6
578	15	19
Total	**29**	**31**

Research

The research associated with TAHD (discussed above) is scheduled for continued data analysis in 2022. 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

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 body 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 recent and ongoing forest thinning projects by the USFS 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 limits the number of individuals allowed access to these lands. The effects of this limited access to elk hunting opportunities are difficult to quantify as the landowners do not own entire Game Management Units. Some hunting individuals elect to pay the access fee, some elect to hunt in another area, and some may decide to quit hunting. It is probable that the reduction in participation over the years (Figure 8) 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 as they impact the Department's goals to maximize recreational access to wildlife and likely reduce hunter participation and recruitment, undermining the capacity to manage elk and other wildlife.

Management Conclusions

Population monitoring indicates that the surveyed portion of the Mount St. Helens elk herd has declined by approximately two-thirds over the past 15 years. While the Department's objective within the Mount St. Helens Elk Herd Plan did call for a reduction of approximately one-third, the population is now significantly below that target. Accordingly, opportunities to harvest antlerless elk have been significantly reduced in recent years. Additionally, estimates of calf:cow ratios during this period suggest calf recruitment rates are at a level that should promote population growth or stability. Despite reductions in antlerless hunting opportunities and apparently robust calf recruitment, the population has not shown indication of reversing its downward trend.

The overall population level, treponeme-associated hoof disease, habitat condition on federal lands, the nutritional condition of the animals, and fee-access systems remain concerns for the Mount St. Helens elk herd. An updated herd plan is needed. 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, prior to the organizational change of wildlife management staff addressing wildlife-human conflicts, and during a time when the elk population was much greater in number.

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North Cascade Elk Herd

ROBERT WADDELL, Wildlife Biologist
CALLIE MOORE, Assistant Wildlife Biologist

Introduction

The North Cascade Elk Herd (NCEH) is the smallest of 10 herds formally managed by WDFW. The herd area is in northwest Washington and consists of five Game Management Units (GMU; Figure 1), which include 407 (North Sound), 418 (Nooksack), 437 (Sauk), 448 (Stillaguamish), and 450 (Cascade).

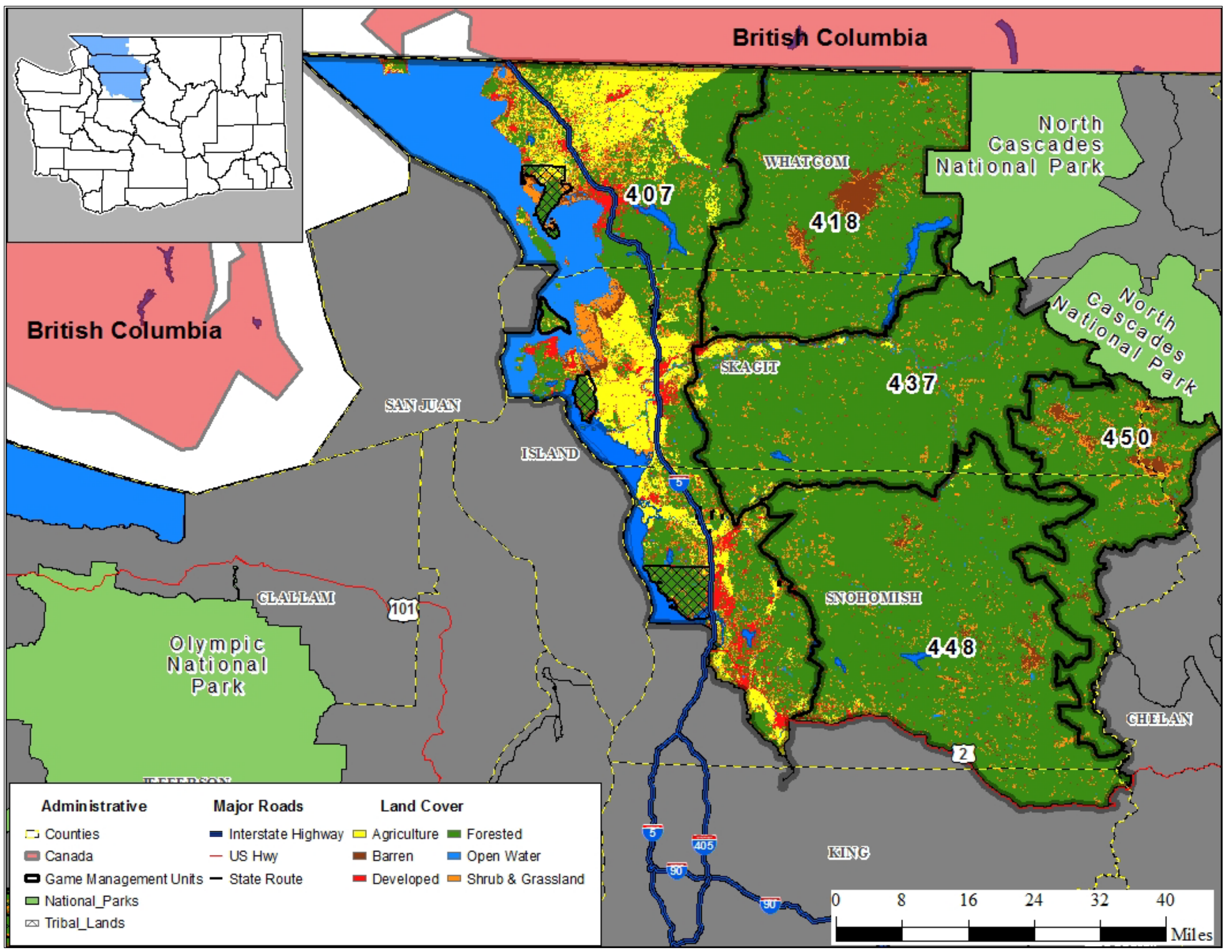

Figure 1. Dominant land use cover types within the five game management units that comprise the North Cascade elk herd area.

Management Guidelines and Objectives

The Department completed the most recent NCEH Plan in 2018 (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 greater than 0.50 for bulls, when bull mortality is actively monitored (WDFW, 2014).

Population Surveys

In cooperation with the Point Elliot Treaty Tribes, the Department conducts an aerial population survey during spring in the core herd area (GMUs 407, 418, and 437). Survey data is analyzed using a variant of mark-resight known as the logit-normal mixed effects model. This method estimates the total elk abundance and size of the cow subpopulation within the survey area (McCorquodale et al., 2011, 2013). However, this strategy can only be used when replicate flights during a survey period are performed. In years when only a single aerial survey is conducted (e.g., 2017, 2018, and 2020), commonly due to weather, cost, or other factors, only a total elk abundance estimate can be calculated. Managers calculate this estimate using the Lincoln-Petersen (L-P) method.

The Department and Point Elliott Treaty Tribes did not conduct a survey in 2022. Thus, the replicate survey flights conducted in spring 2021 represent the most recent population survey. That survey estimated total elk abundance within the core herd area to be 1,194 (95% CI = 1,108–1,287) elk (Figure 2). Estimates of bull:cow and calf:cow ratios derived from uncorrected observation data were 18 bulls:100 cows (Figure 3) and 32 calves:100 cows (Figure 4), respectively. Bull:cow ratios are within the post-hunt management objective of 12–20 bulls:100 cows (Figure 3), and calf:cow ratios represent good to excellent recruitment rates (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. Since then, general season opportunities have been limited. However, special permit opportunities have increased as the population grows. Similarly, antlerless harvest has expanded over the past few years and is primarily limited to agricultural areas where damage to commercial crops may be high.

Estimates of antlered harvest during 2015–2021 remained steady and were higher, in general, than in previous years (Figure 5). This is likely attributed 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. Estimates of antlerless harvest have remained steady since 2014 (Figure 5) and occur primarily during WDFW special permit seasons (Figure 7).

The estimated number of days hunters spent pursuing elk within the NCEH area during general recreational seasons, where over-the-counter license opportunities are available, remained steady from 2015–2017 (Figure 8). This metric increased from 2018–2020 (Figure 8) due to significant growth in the number of hunters seeking general season elk hunting opportunities in northwest Washington. In 2021, the number decreased, likely due to changes in the structure and length of the late archery and muzzleloader hunting seasons (Figure 8). During the 2021 general recreational season, the estimated number of elk harvested for every 100 hunter days was similar to 2020 but less than in previous years (Figure 9). An increase in the number of licensed hunters and other undetermined factors may have caused this to occur.

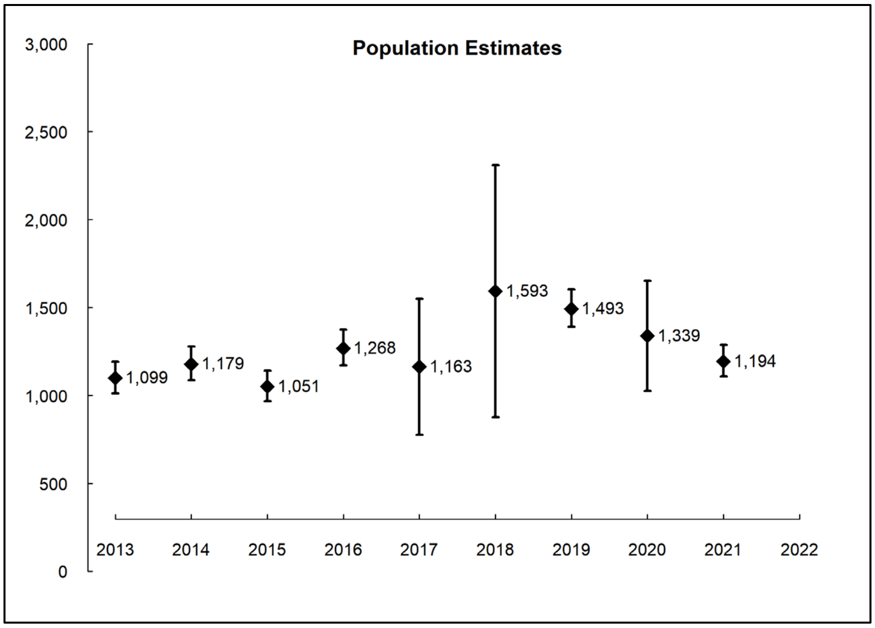

Figure 2. Estimates of total elk abundance using a variant of mark-resight or a Lincoln-Petersen estimator (2017, 2018, and 2020) with associated 95% confidence intervals in the core range of the North Cascade elk herd area (GMUs 407, 418, and 437), spring 2013-2022. No survey occurred in 2022.

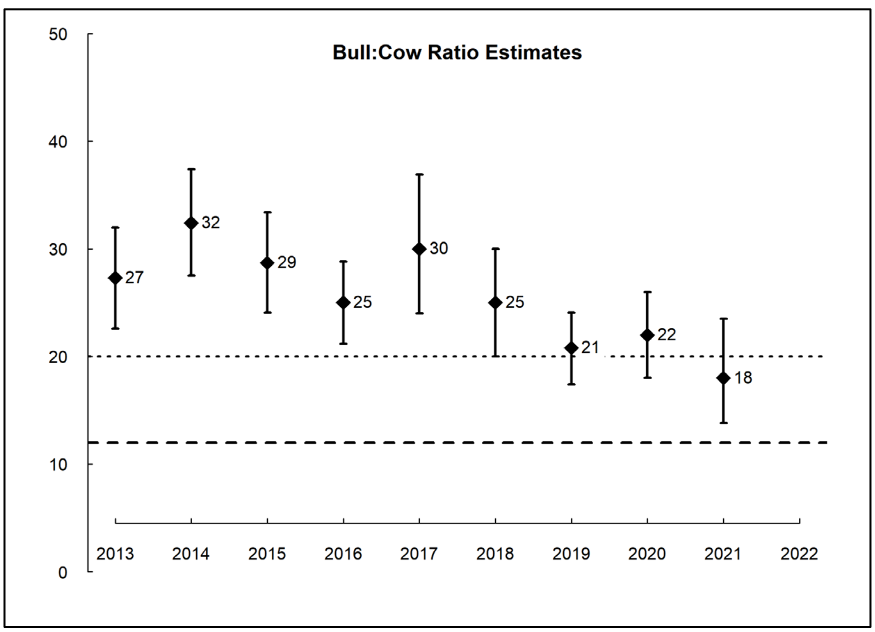

Figure 3. Estimates and associated 95% confidence intervals of post-hunt, bull:cow ratios in the core range of the North Cascade elk herd (GMUs 407, 418, and 437), spring 2013-2022. The dashed lines represent the WDFW post-hunt objective range of 12–20 bulls:100 cows. No survey occurred in 2022.

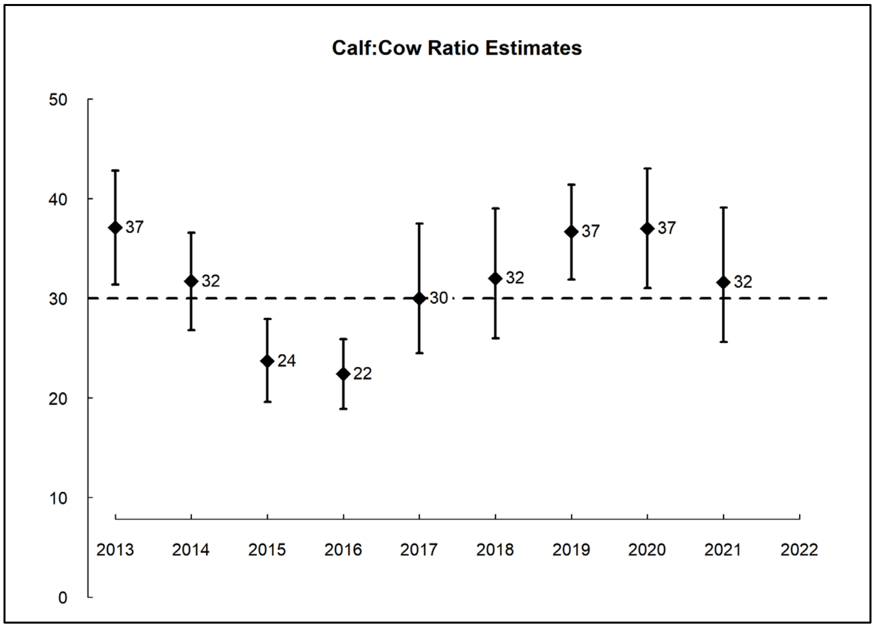

Figure 4. Estimates and associated 95% confidence intervals of post-hunt calf:cow ratios in the core range of the North Cascade elk herd (GMUs 407, 418, and 437), spring 2013-2022. The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth. No survey occurred in 2022.

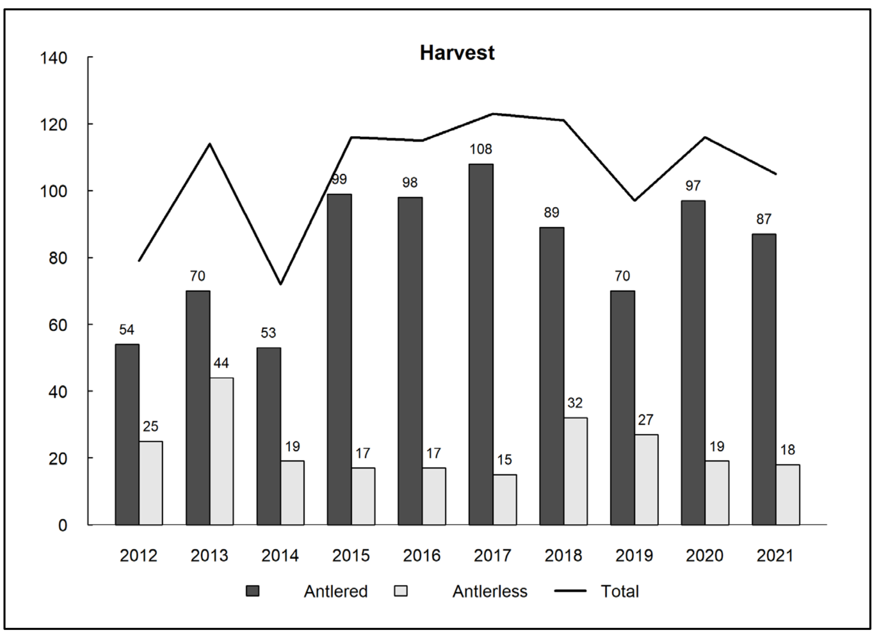

Figure 5. Estimated number of antlered and antlerless elk harvested in the North Cascade elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department and during established Tribal seasons, 2012–2021. Estimates of Tribal harvest were derived from annual harvest reports compiled by the Northwest Indian Fisheries Commission. Estimates do not include elk harvested in association with WDFW damage permits (see Human-Wildlife Interaction below).

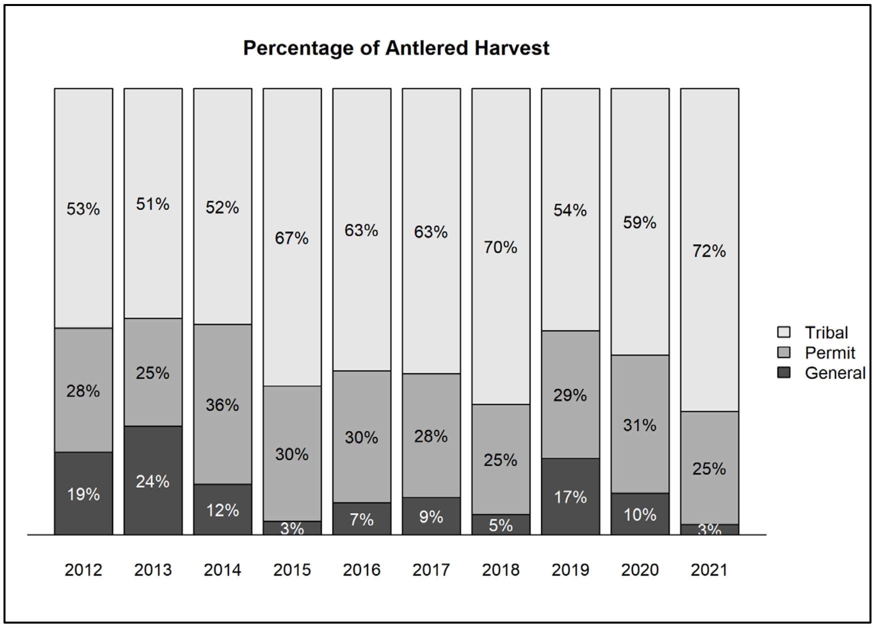

Figure 6. Estimated percentage of antlered elk harvest in the North Cascade elk herd area during recreational (General and Permit) and Tribal seasons, 2012–2021.

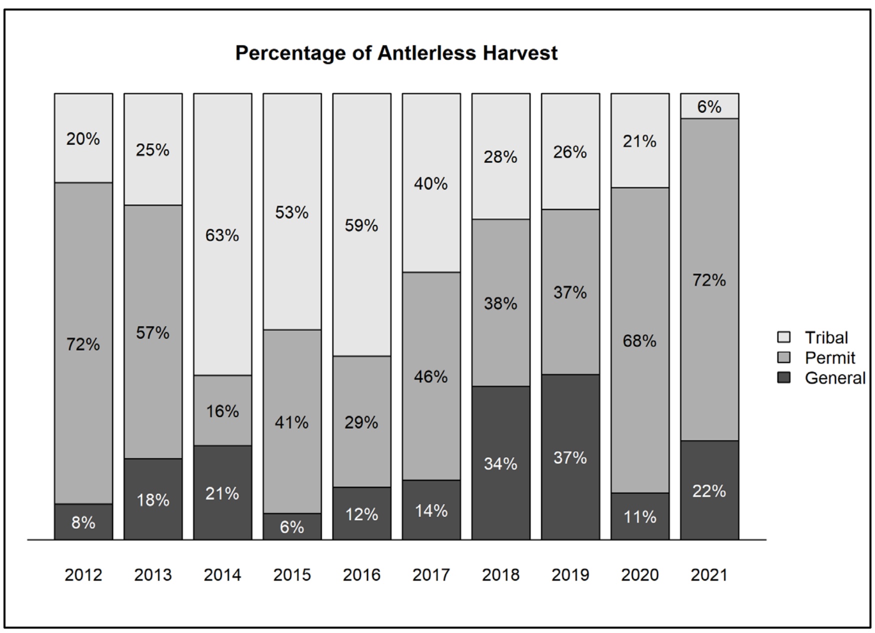

Figure 7. Estimated percentage of antlerless elk harvest in the North Cascade elk herd area during recreational (General and Permit) and Tribal seasons, 2012–2021.

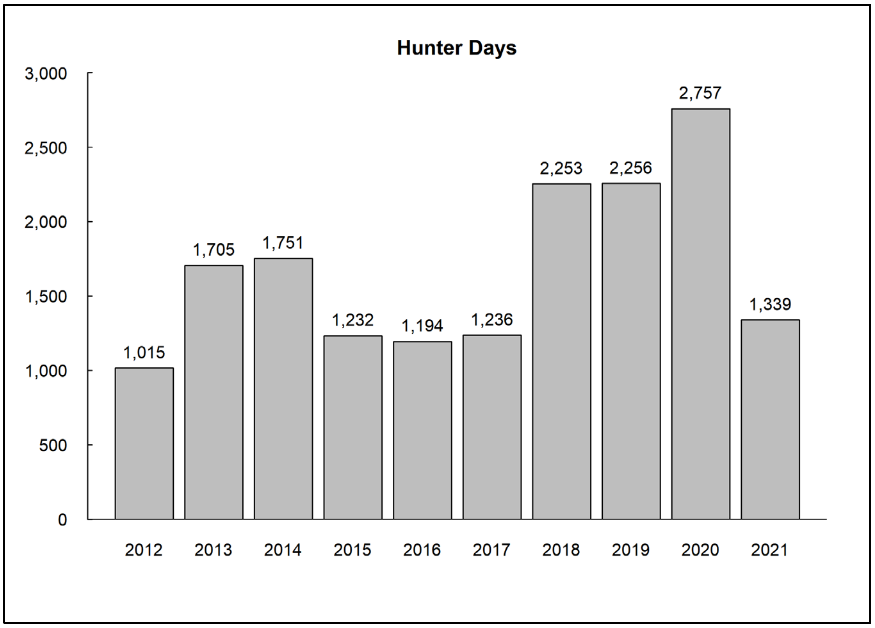

Figure 8. Estimated number of days hunters spent pursuing elk in the North Cascade elk herd area during recreational seasons that provided general, over-the-counter opportunities, 2012-2021.

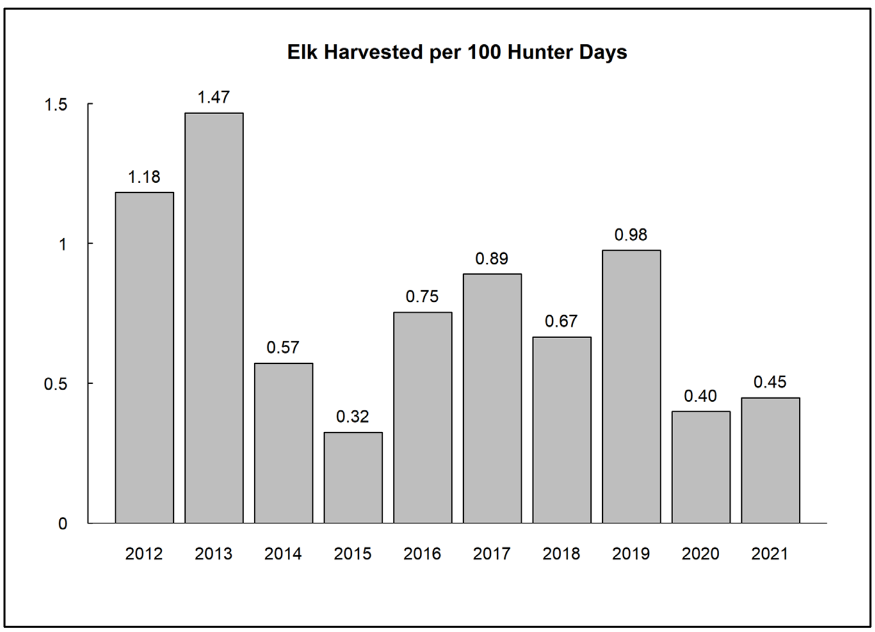

Figure 9. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the North Cascade elk herd area during recreational seasons that provided general, over-the-counter opportunities, 2012-2021.

Survival and Mortality

Common predators of elk that occur in the NCEH area include black bears and cougars. Though state and federally listed, 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. In 2017, a single wolf in Skagit County was captured and collared by biologists. The following year, location data from the collared wolf allowed biologists to confirm that an unknown wolf had paired with the collared wolf. This was the first documented wolf pack in western Washington since they were extirpated in the early 1930s. The pair was named the Diobsud Creek pack (WDFW et al., 2021). Surveys of the area in 2020 and 2021 detected only a single wolf was maintaining the territory, thus the Diobsud Creek pack was removed from the Department's list of designated packs.

Although biologists have not documented a substantial effect of winter weather on elk survival in this herd, the weather does influence their distribution. However, when severe winter conditions persist, elk become concentrated in low-elevation areas, including the Skagit River and Acme Valleys. The potential for human-wildlife conflict, especially with agricultural producers, is high when this occurs.

The Department monitored the survival of adult female elk and branch-antlered bulls in the NCEH area from 2005–2006 and estimated annual survival rates to be >0.90 for both sex classes before reinstating harvest opportunities in 2007 (McCorquodale et al., 2011). Following the resumption of bull harvests only, the survival of branch-antlered bulls was estimated to be 0.68 (95% CI = 0.50–0.82). Of the 270 mortality events documented during 2005–2011, biologists attributed 77% (207 elk) to harvest-related causes, 14% (38 elk) to elk-vehicle collisions, and 4% (11 elk) to natural causes (e.g., predation, disease, accidents, etc., combined).

Habitat

Forest management practices on private industrial and state forestlands generally benefit the NCEH by creating a mosaic of habitat types. Specifically, clear-cuts and young regenerating stands provide a forage base that is commonly absent in mature forests, though the size, location, and topography of clear-cuts, as well as the intensive use of herbicides, can impact the value of these early seral stage forest openings for elk. In contrast to state and commercial forestlands, that portion of the NCEH area under federal ownership is dominated by mature timber that provides little benefit to elk.

Human-Wildlife Interaction

The damage removal period for elk ran from July 1, 2021, thru March 31, 2022. During that period, WDFW received 56 elk-related complaints, an increase from the 36 complaints received during the 2020–-21 season, with most complaints involving damage to lands, fences, and equipment owned or operated by commercial producers. The remainder came from individuals not engaged in agricultural or livestock production and involved damage to ornamental and fruit trees, gardens, and landscaping.

Fifty-six landowner permits and 13 Master Hunter permits were issued during 2021–2022 to address elk damage in GMUs 407, 418, and 437. Most of the damage permits were focused in the Skagit Valley portion of GMU 437 during the state-authorized removal period. Of the issued damage permits, 41 elk (5 bulls, 36 cows) were harvested.

Research

The Department continues to monitor eight of nine cow elk captured in GMU 437 during February–March 2021. Each elk was fitted with a GPS/Satellite collar to track movements and aid in population monitoring. One elk died in July 2021 of unknown causes.

Management Concerns

Treponeme-associated hoof disease

The Department confirmed the presence of Treponeme-associated hoof disease (TAHD) in the NCEH area in 2016, with one confirmed case in the Skagit River Valley and another occurring 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, assuming they would have reduced survival or potential reproductive probability seems reasonable. However, how TAHD affects the population dynamics of herds where it occurs is still being determined. The Department is currently investigating the effects of TAHD on elk population dynamics in the Mount St. Helens elk herd area and research to estimate the distribution and prevalence of TAHD better. 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 calf recruitment rates have been at levels that would promote population growth or stability in most years. Biologists did not attribute the lower population estimate in 2021 to a decline, citing challenges associated with using a pilot inexperienced with surveying elk in the area. In addition, estimated bull:cow ratios and the most 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 population to continue to increase.

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North Rainier Elk Herd

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Introduction

The North Rainier elk herd area is located in west-central Washington and consists of 8 Game Management Units (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.

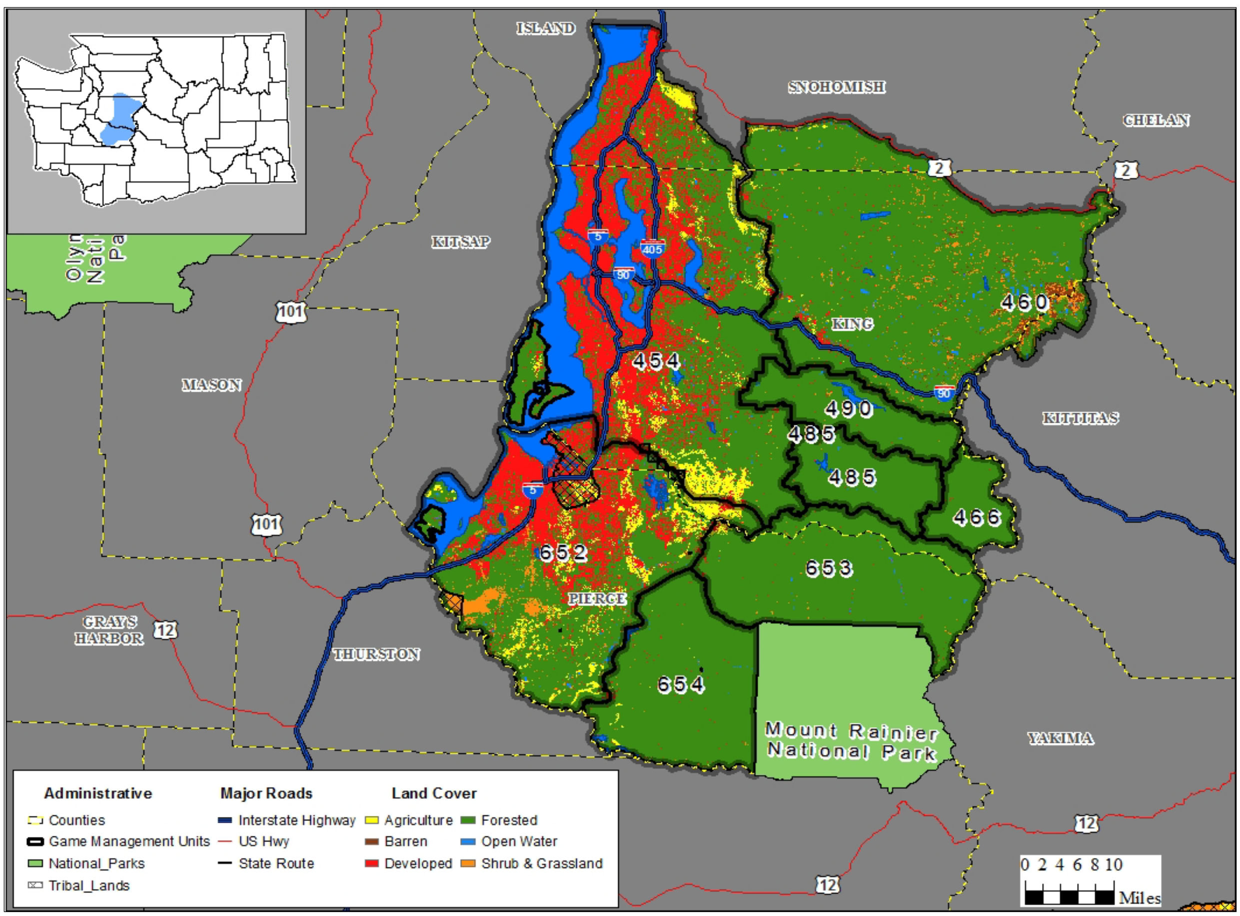

Figure 1. Dominant land use cover types within the 8 game management units that comprise the North Rainier elk herd area.

Management Guidelines and Objectives

The Department updated the North Rainier Elk Herd Plan (WDFW, 2020, North Rainier Elk Herd Plan), including population objectives for each of the herd's subunits and the herd overall. Management objectives include developing a survey protocol(s) for the herd by 2025; maintaining a herd size of 4,850 elk; maintaining a 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 in 2020 and 2021 was hampered by the COVID-19 pandemic restrictions on flights. Limited surveys took place in 2020, 2021, and 2022. Additional surveys are planned for the North Rainier Elk Herd in spring 2023.

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 most of the 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 (Figure 2). 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 3 and 4). Estimates of elk abundance steadily increased 2007-2012 but stabilized 2013-2017. Estimates of post-hunt bull:cow ratios were stable 2012-2017, and MIT reports ratios remain at or above objectives in 2021 (MIT data not provided after 2017). Estimates of post-hunt calf:cow ratios were high from 2012-2017. According to MIT, that ratio has since declined but not to a level of concern. MIT continues to monitor cow elk survival using a sample of radio-marked animals ranging from 6-8% of the estimated cow elk in the 653 subpopulations. The updated North Rainier elk herd plan sets the population objective for GMU 653 at 1,800 elk (WDFW, 2020).

WDFW surveyed portions of GMU 654 for the first time in April 2022. While the hope was to survey most of that unit, limited funding combined with increased expense of helicopter surveys allowed only the western half to be surveyed. The survey's main purpose was to confirm speculation that this GMU supports few elk, especially in comparison to GMUs 652 and 653. That speculation was confirmed with only 23 elk located over an expansive area of suitable habitat (note, the additional areas of this GMU should be targeted for future surveys).

WDFW also surveyed a portion of GMU 460 (outside Elk Area 4601) in April 2022. This area has not been surveyed in several decades, but anecdotal evidence suggests elk are using some of the good habitat during varied times of the year. This effort was to determine if aerial surveys were feasible in some of the areas with more dense vegetation (i.e., can observers see the ground) as well as locate any elk possible. Although no elk were located during the survey, a large area was determined to be suitable for future aerial survey efforts.

MIT also conducts annual aerial composition surveys and uses mark-resight to estimate elk abundance in GMU 485. They estimated elk abundance to be 425 (95% CI = 378-472) elk in 2022. These estimates are derived from a post-2021 hunt survey effort in spring 2022 (Figure 5; see previous reports here). GMU 485 surveys over the past three springs (2020-2022; Figure 5) have shown a slight drop in estimate numbers. Survey conditions, the number of marked animals found during the survey, habitat changes, potential outmigration or other area occupancy pattern changes, among other factors, can all influence annual estimate results. Resulting estimates of post-hunt bull:cow and calf:cow ratios were 13:100 (95% CI = 8–17) and 20:100 (95% CI = 14–26), respectively (Figures 6 and 7). Estimates of post-hunt bull:cow ratios have varied but have consistently been within the objective. Estimates of post-hunt calf:cow ratios have also varied but have generally been at or above levels that should promote population stability. GMU 466 is not surveyed at this time. Therefore, no GMU 466 population estimates are available for use in reference to the herd population objective. The North Rainier elk herd plan sets the population objective for GMU 466 and 485 combined at 600 elk (WDFW, 2020).

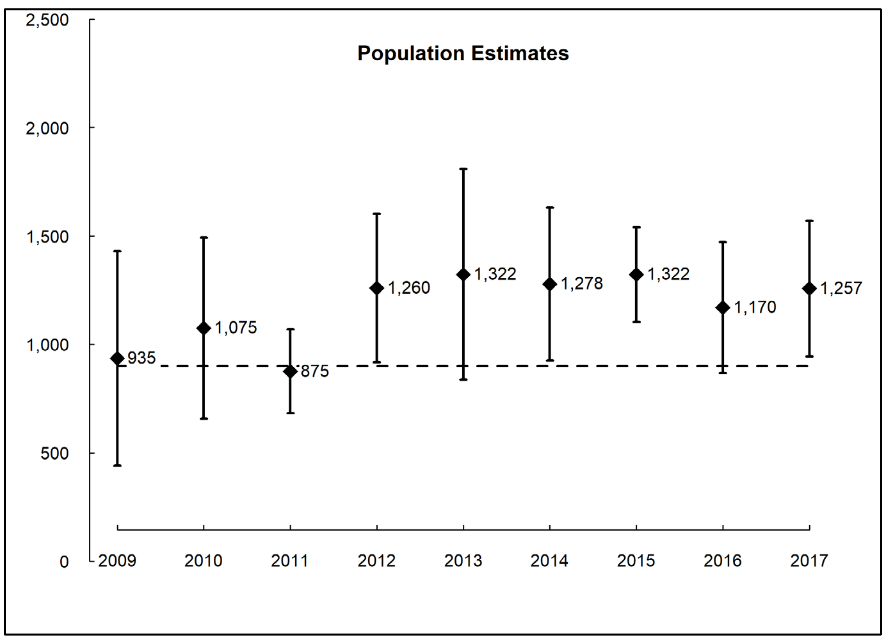

Figure 2. Mark-resight estimates of total elk abundance with associated 95% confidence intervals in GMU 653, spring 2009-2017 (MIT unpubl. data). The dashed line represents the 2020 management objective for total elk abundance (900 elk).

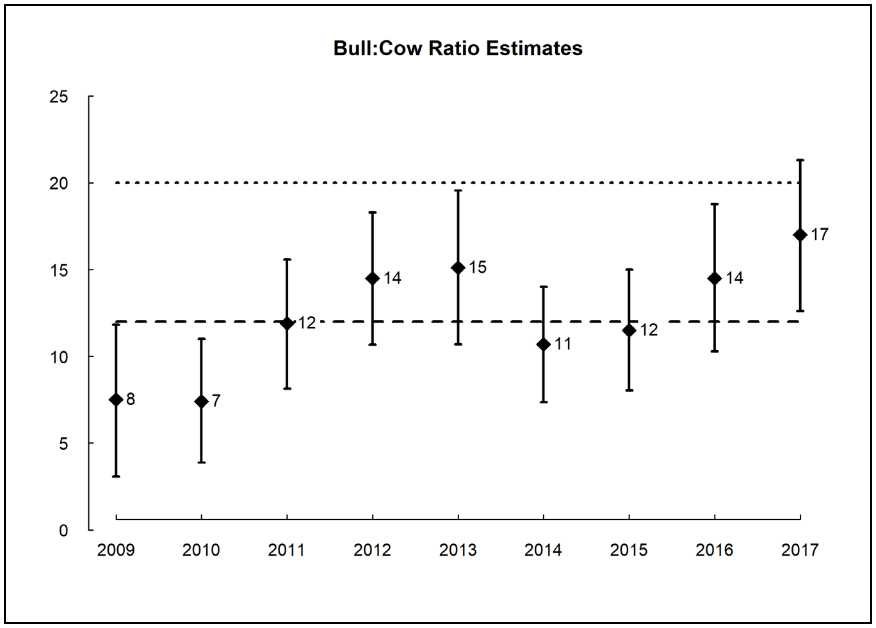

Figure 3. Estimates and associated 95% confidence intervals of post-hunt bull:cow ratios in GMU 653, spring 2009-2017 (MIT unpubl. data). The lines represent the objective range of 12-20 bulls:100 cows.

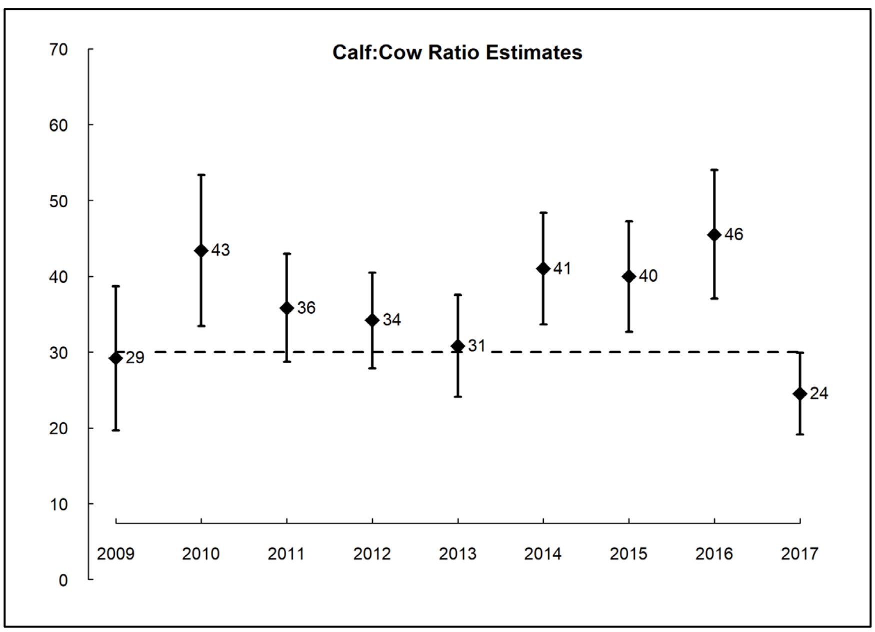

Figure 4. Estimates and associated 95% confidence intervals of post-hunt calf:cow ratios in GMU 653, spring 2009-2017 (MIT unpubl. data). The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth.

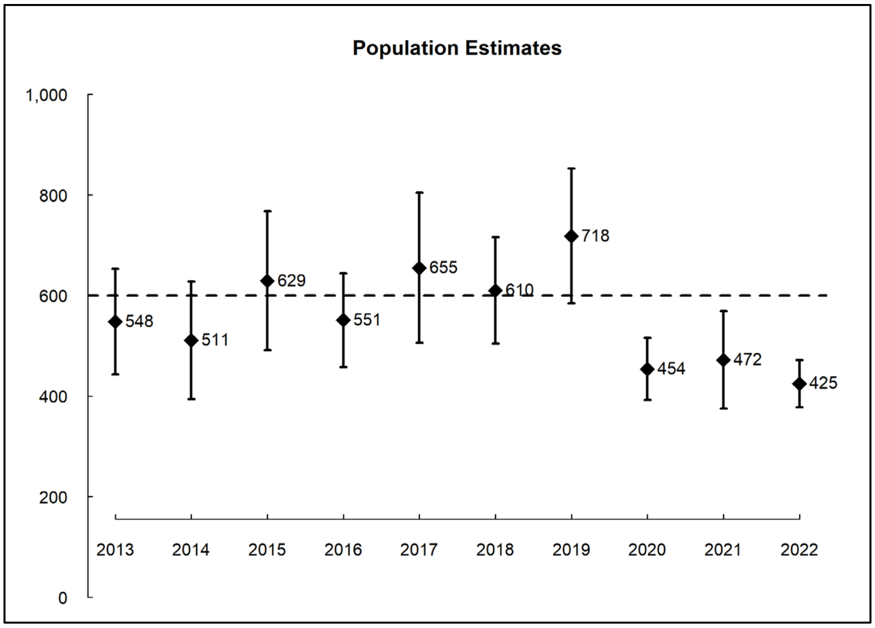

Figure 5. Mark-resight estimates and associated 95% confidence intervals of total elk abundance in GMU 485, spring 2013-2022 (MIT unpubl. data.). The dashed line represents the elk abundance management objective, adopted in 2020 (600 elk; GMUs 485 and 466 combined). Note that no recent surveys have been conducted in GMU 466. Therefore, GMU 466 is not included in the figure above. GMU 466 is an unknown portion of the population objective of 600 elk across GMUs 485 and 466.

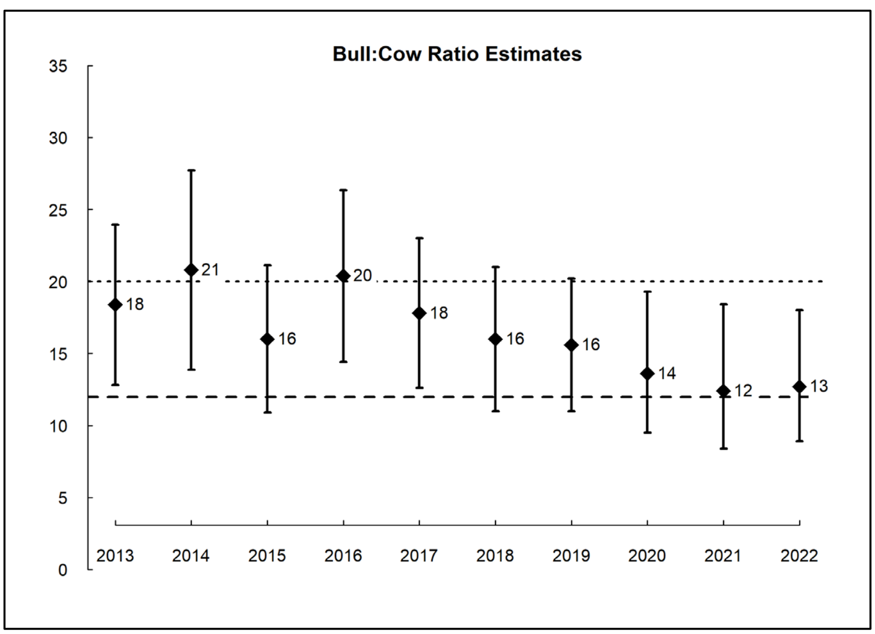

Figure 6. Estimates and associated 95% confidence intervals of post-hunt bull:cow ratios in GMU 485, spring 2013-2022 (MIT unpubl. data). The lines represent the objective range of 12-20 bulls:100 cows.

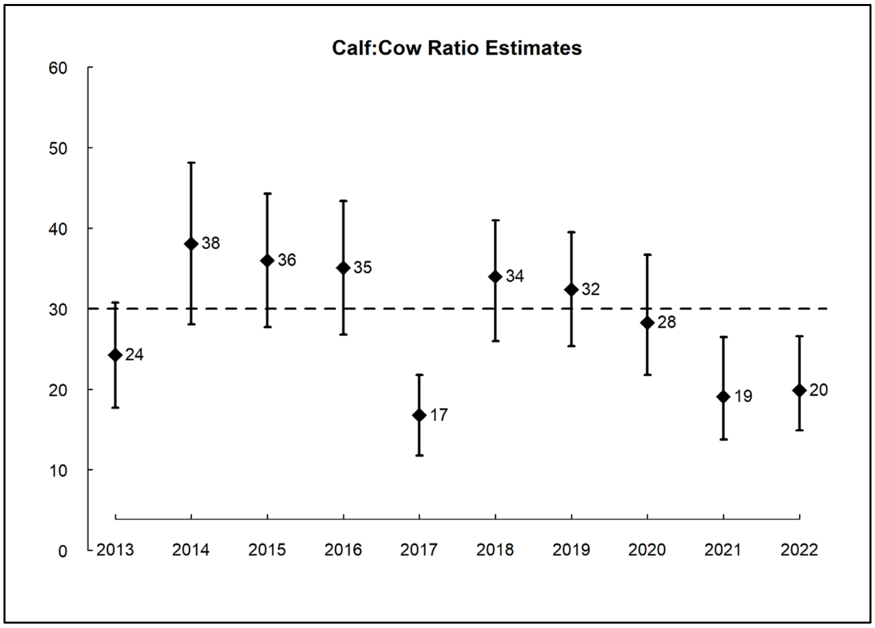

Figure 7. Estimates and associated 95% confidence intervals of post-hunt calf:cow ratios in GMU 485, spring 2013-2022 (MIT unpubl. data). The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth.

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 from 2010-2018. Estimates of elk abundance indicate that elk numbers in Elk Area 4601 have been relatively stable since 2012, except for a significant increase in 2018 (Figure 8). The USVEMG and WDFW do not believe this represents an actual increase in the elk population but is a function of the model used to estimate herd size.

WDFW, in partnership with NW Trek and MIT, launched a pilot project for citizen science elk monitoring 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 volunteers increased in 2016, and they collected meaningful data. The highest one-day count, according to the survey results, was 180. According to the area conflict specialist, this survey has not been successful due to a lack of participation and is not currently an active project.

Elk Area 6013 includes much of the Muckleshoot Indian Reservation and areas to the south and west. At the same time, Elk Area 6014 has traditionally been an area of high elk damage to private property. WDFW and MIT surveyed Elk Area 6013 and 6014 in 2017 and located 192 elk with bull:cow and calf:cow ratios of 15:100 and 37:100, respectively (WDFW, unpubl. data).

WDFW conducted a survey of these two elk areas in April 2022, partially to determine if additional harvest pressure in 6014 over the past five years is reducing that sub-herd (and indirectly, damage). A total of 11 elk were located during the survey in 6013/6014, significantly fewer elk than were observed the last time this was surveyed in 2017. While the bull:cow ratio for both areas combined (19) suggests an increasing population, the calf:cow ratio (15) suggests a declining population. Note that calves can be more difficult to differentiate from cows in a spring flight, and some calves may have been misidentified, which would result in a higher calf-to-cow ratio than reported here. The bull ratio was higher in 2022 than last surveyed in 2017 (bull:cow ratio = 15) and in 2013 (bull:cow ratio = 5). The significantly fewer elk counted in the 2022 survey were surprising and should be monitored as to whether an actual population decline has occurred. If not, and additional surveys reflect higher (normal) levels, the bull ratio suggests that the elk population in 6014 might withstand additional hunting pressure, especially bulls, to reduce elk damage.

WDFW surveyed a very small portion of Elk Area 4601 in April 2022 (effort curtailed due to gusty winds; survey continued in more protected areas of GMU 460). Nine cows, two calves, and one bull were located during this portion of the survey.

The Department has also collaborated with MIT, the U.S. Geological Survey, the National Park Service, and the 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 2017 and used the model to estimate an average of 359 elk in the subalpine meadows of GMU 653 and within the park during surveys conducted from 2008-2017. This equates to an average density of 3.5 elk/km2 during surveys. On average, the survey crews detected approximately 81-83% of elk estimated present.

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 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.

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 their 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.

The total harvest within the herd area has been steadily increasing and averaged 628 elk, 2012-2021 (Figure 9). The total State harvest was 629 elk, and the total Tribal harvest was 134 in 2021. Most antlered and antlerless elk harvest occurs during general seasons (Figures 10 and 11). Hunter effort (Figure 12) and harvest per unit effort (Figure 13) has also been increasing during the same period.

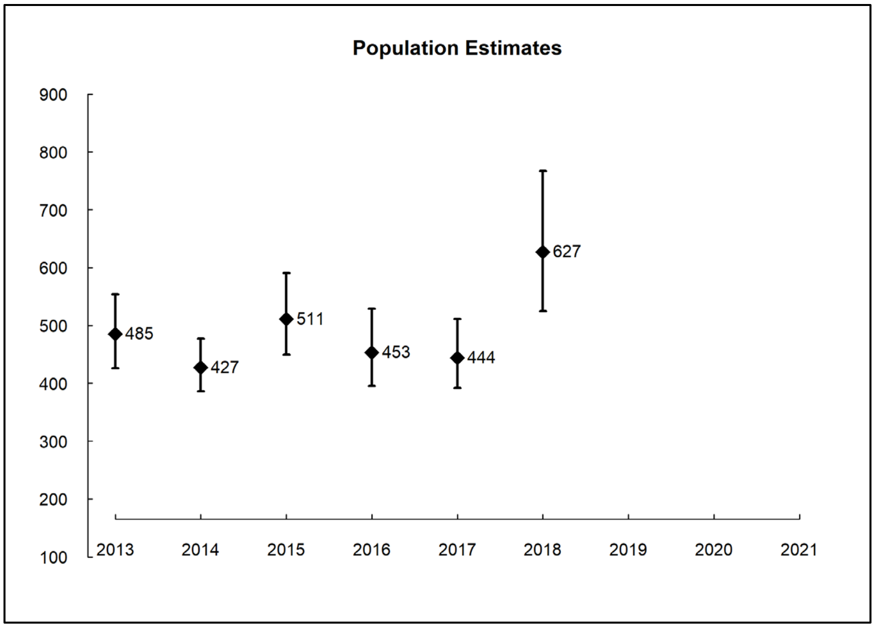

Figure 8. Mark-resight estimates and associated 95% confidence intervals of total elk abundance in Elk Area 4601, spring 2012–2018 (data not collected 2019-2022).

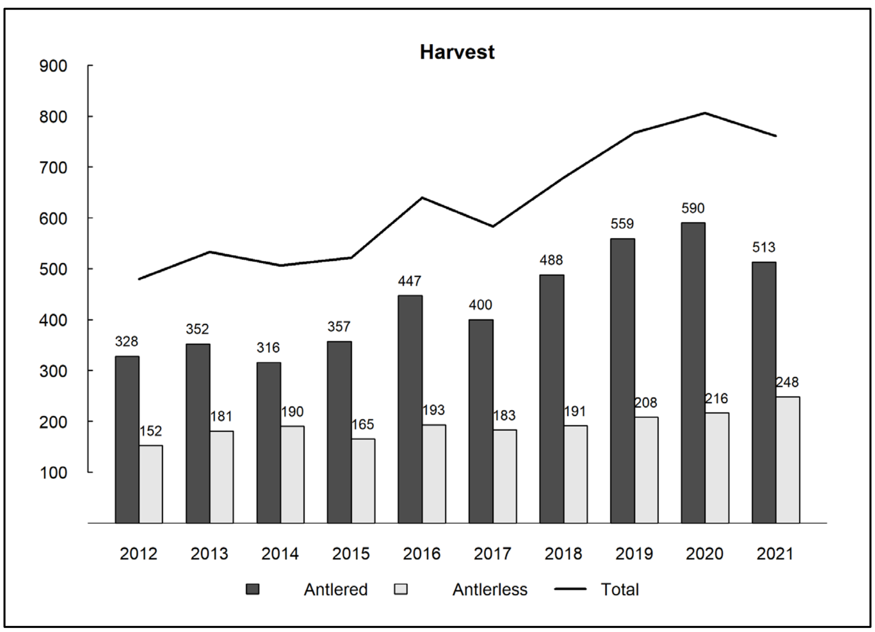

Figure 9. Estimated number of antlered and antlerless elk harvested in the North Rainier elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department and during established Tribal seasons, 2012-2021. Estimates of Tribal harvest were derived 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).

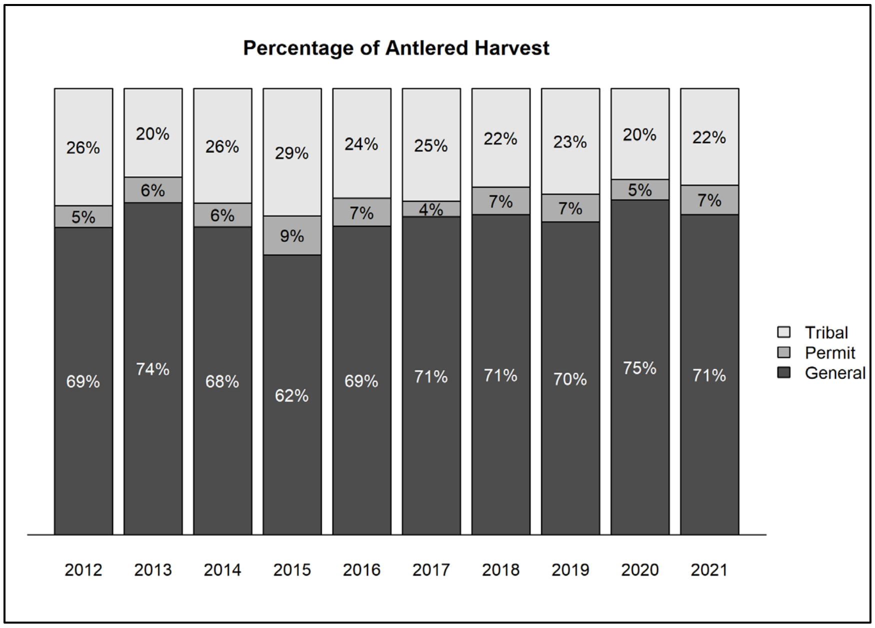

Figure 10. Estimated percentage of recreational antlered harvest in the North Rainier elk herd area that occurred during general and permit seasons and the percentage of harvest that occurred during established tribal seasons, 2012-2021.

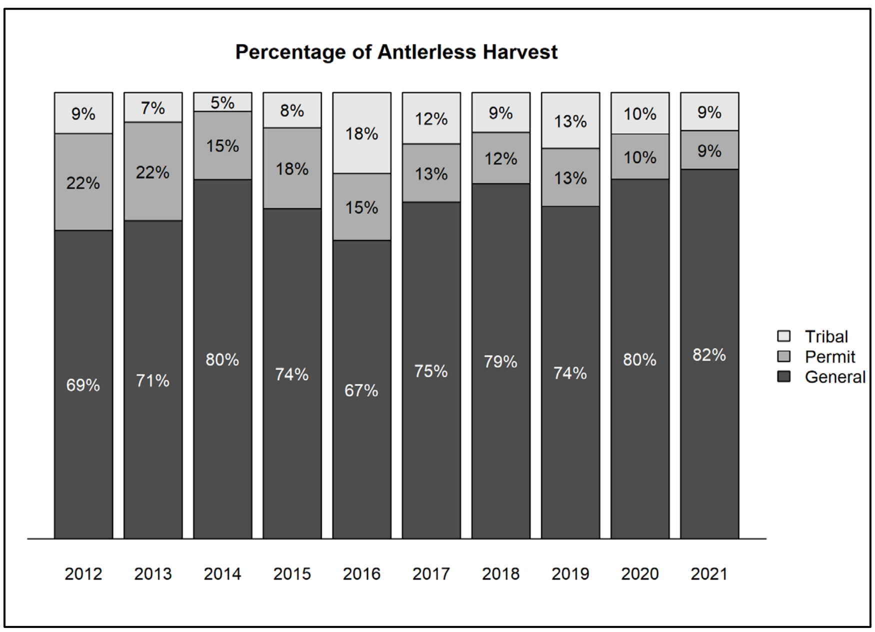

Figure 11. Estimated percentage of recreational antlerless harvest in the North Rainier elk herd area that occurred during general and permit seasons and the percentage of harvest that occurred during established tribal seasons, 2012-2021.

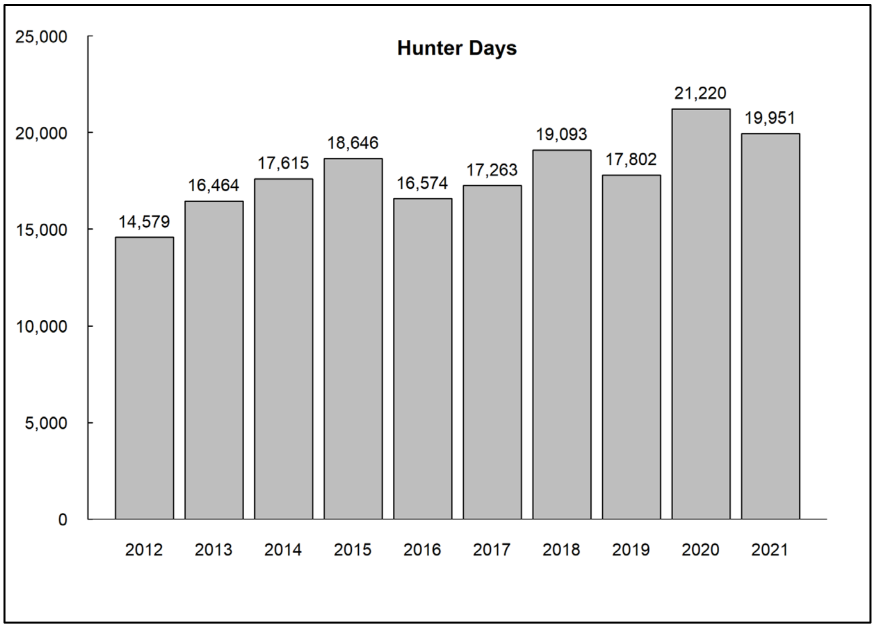

Figure 12. Estimated number of days hunters spent pursuing elk in the North Rainier elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

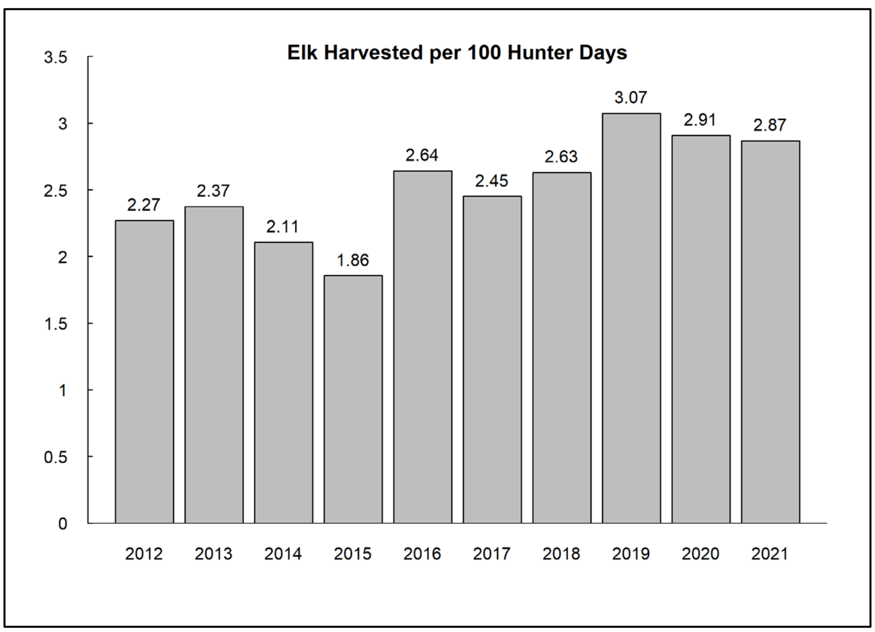

Figure 13. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the North Rainier elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

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 cougars ranged from 0.20-0.71. The MIT research's lowest estimates of cow and calf survival occurred in the late 1990s and early 2000s. They indicated that cougars were the leading cause of mortality for adult females and calves.

In response to these findings, MIT implemented a cougar reduction program from 2001 through 2007 to improve 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 co-occurred with implementing more conservative hunting seasons and various habitat improvement projects, likely benefiting elk. By 2018, female and calf survival was still occurring at levels promoting 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.

Pierce County Planning and Land Services have adopted the 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 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 of reducing elk damage and are generally attempted prior to lethal measures. WDFW Conflict Specialists and landowners use various 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 Plantskydd.

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, and landowner damage permits. See Table 1 for a summary of active DPCA agreements, permits issued to landowners allowing the taking of elk causing agricultural damage, and the number of elk killed in the North Rainier Elk Herd during the 2021-2022 season. Collectively, these hunts are designed to decrease the number of elk causing damage and to haze elk from the area.

Table 1. Damage Prevention Cooperative Agreements, number of permits to lethally remove elk causing damage to agricultural crops and resulting kills, North Rainier Elk Herd, April 2021 through July 21, 2022.

GMU	DPCA	Permits Issued	Antlered Harvest	Antlerless Harvest	Total Harvested
454	9	7	1	2	3
460	3	1	0	0	0
466	0	0	0	0	0
485	0	0	0	0	0
490	0	0	0	0	0
652	24	31	0	19	19
654	5	12	0	8	8
TOTAL	**41**	**51**	**1**	**29**	**30**

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. The Upper Snoqualmie Valley Elk Management Group was formed in 2008 in response to damage complaints within the city limits of North Bend and Snoqualmie, and elk-vehicle collisions on I-90. 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 concerns related to elk-human interactions. Further, the Washington Department of Transportation has initiated monitoring and collaborative academic studies to examine vehicle-elk collisions along I-90.

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. Antlerless elk harvest was added to general season hunts aimed at reducing the herd in these localized areas. Regional master hunter permit holders were also used to harvest elk on specific properties specified by the Wildlife Conflict Specialists in 6014 to curtail damage further.

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.

In addition to retaining permit opportunities in the expanded Elk Area 6054, the Department is considering additional opportunities to harvest antlerless elk in GMU 654 to assist with mitigating elk damage complaints.

Research

WDFW is a member of the White River Elk Herd Technical Committee, comprised of state, federal, and tribal biologists and researchers who comprise 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 Survey research project from 2008-2017 (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 remain a concern in portions of the herd area.

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. 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 from samples collected in GMU 454 and 485. It is believed to be present in all remaining GMUs of the North Rainier Elk Herd based on observations and reports from WDFW staff and the general public. 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.

Management Conclusions

Available data indicates the North Rainier elk herd is stable or increasing in most areas and meeting the Department's management objective for bull escapement throughout the herd area. The Department will continue efforts to limit the expansion of this herd in areas where the potential for conflict is high (e.g., agricultural areas, urban interface, etc.) and will promote population growth in areas that provide hunting and recreational viewing opportunities. In addition, limited-entry permit hunts offered in GMUs 485 and 653 are some of Washington's most popular because of the opportunity to harvest and view mature bulls coupled with high success rates. As such, the Department will continue to manage harvest opportunities in these GMUs through special permits.

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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.

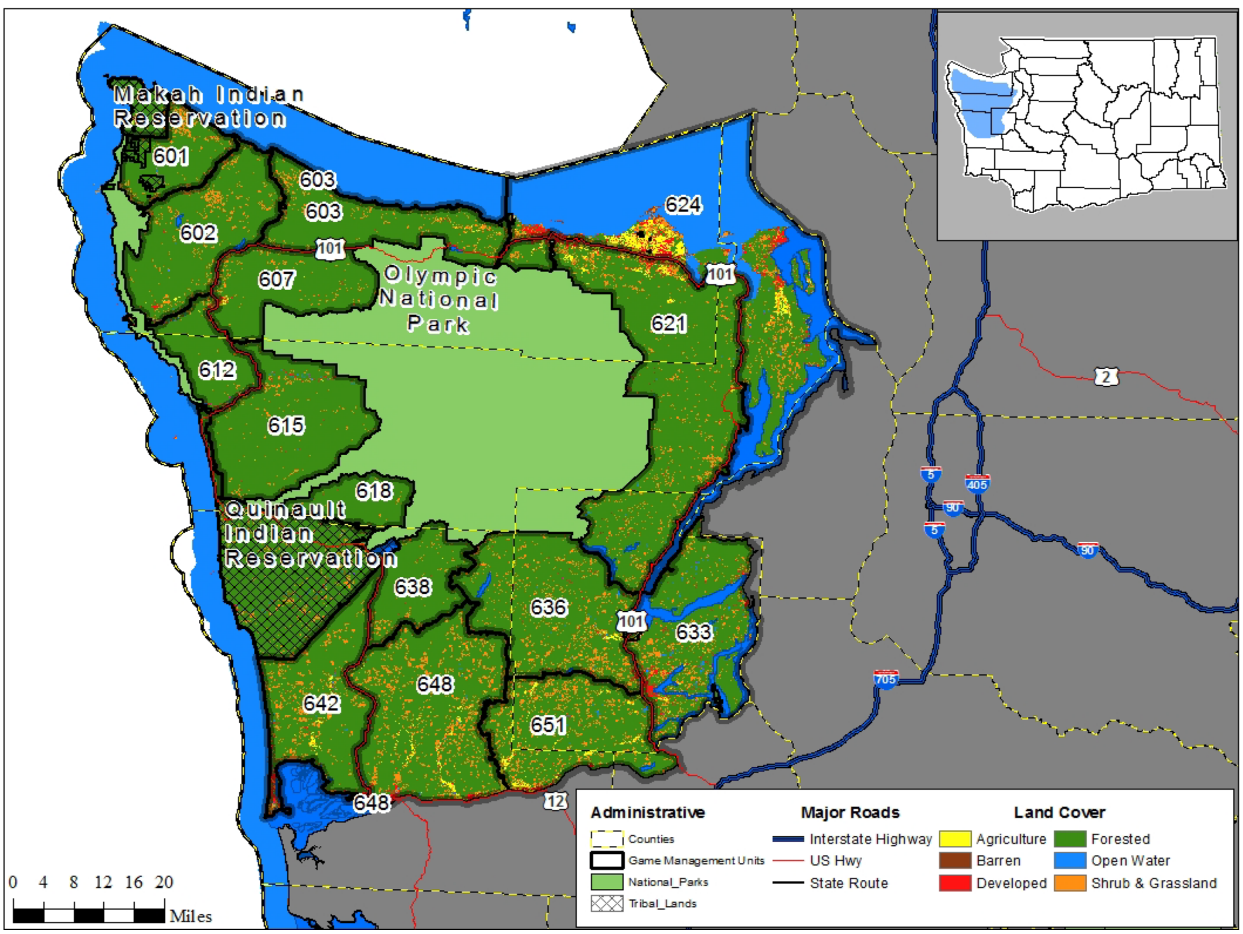

Figure 1. Dominant land use cover types within the 14 game management units that comprise the Olympic elk herd area.

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 of 15-35 bulls:100 cows and a post-hunt population of 12-20 bulls:100 cows (WDFW, 2014).

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, WDFW prefers to see post-hunt ratios that are ≥ 30 calves:100 cows and becomes concerned when they are below 25 calves:100 cows in consecutive years.

The primary means the Department manages for a stable to increasing elk population is through hunting regulations. Thus, we retain a relatively conservative state elk harvest strategy in the Olympic elk herd area through a 3-point minimum bull restriction and limited cow harvest. Most, but not all, antlerless hunting opportunities are related to reducing human-elk conflict.

Population Surveys

The Department and several Treaty Tribes that have hunting rights on the Olympic Peninsula 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 when collected, but the most emphasis for surveys is on the post-hunt period. Estimates of post-hunt bull:cow ratios from 2018-2021 were within management objectives but were lower than objectives in 2022 (Figure 1). 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 travel 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 2).

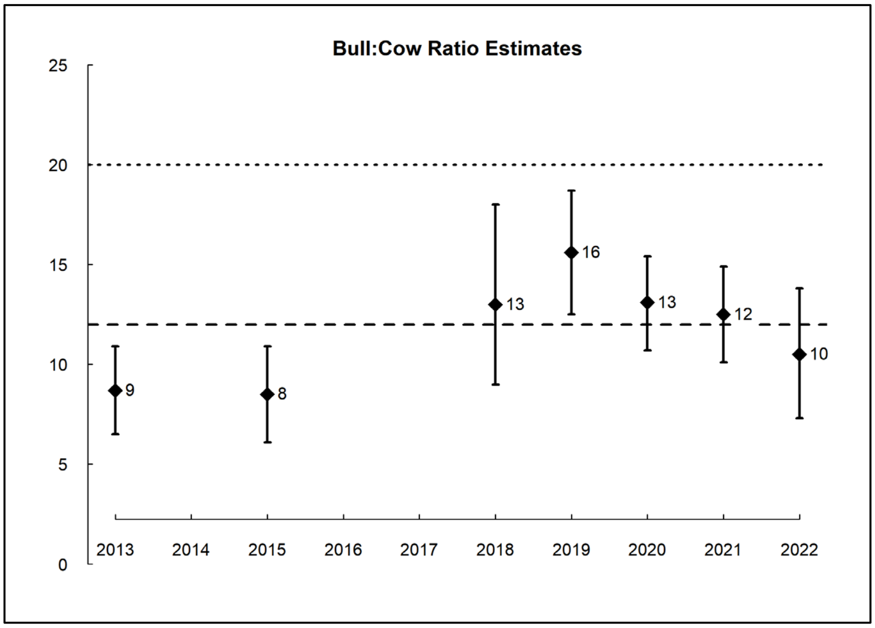

Figure 1. Estimates and associated 95% confidence intervals of post-hunt bull:cow ratios in the Olympic elk herd area, spring 2013-2022. The dashed lines represent the objective range of 12-20 bulls:100 cows. Post-hunt ratios from 2014, 2016, and 2017 are not included because biologists only conducted surveys in a single GMU during these years.

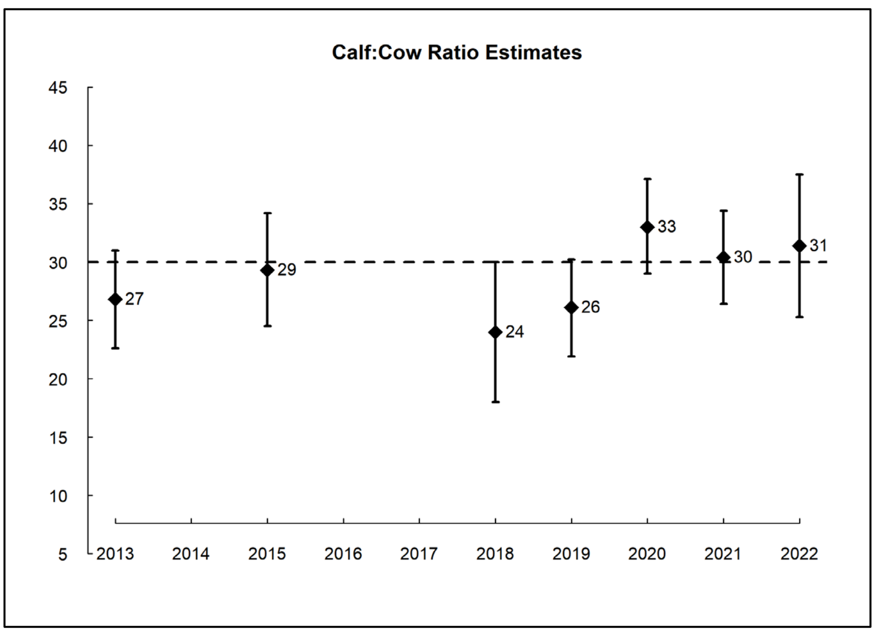

Figure 2. Estimates and associated 95% confidence intervals of post-hunt calf:cow ratios in the Olympic elk herd area, spring 2013-2022. The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth. Post-hunt ratios from 2014, 2016, and 2017 are not included 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 255 and 271 elk, respectively, 2012-2021, while estimates of harvest, including tribal harvest, have averaged 456 elk, 2012-2021. Elk harvest in 2021 decreased considerably from recent years (Figure 3). State hunting typically accounts for a greater percentage of the bull harvest in the Olympic elk herd area (Figure 4). In comparison, Tribal hunting usually accounts for a greater percentage of the cow harvest (Figure 5). Hunter effort, reported as hunter days, decreased from 2020 (Figure 6). The catch per unit effort (CPUE) estimate in 2021, reported as the number of elk killed per 100 days, was at a 10-year low (Figure 7). Total harvest in Figure 5 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; 2012-2020/21).

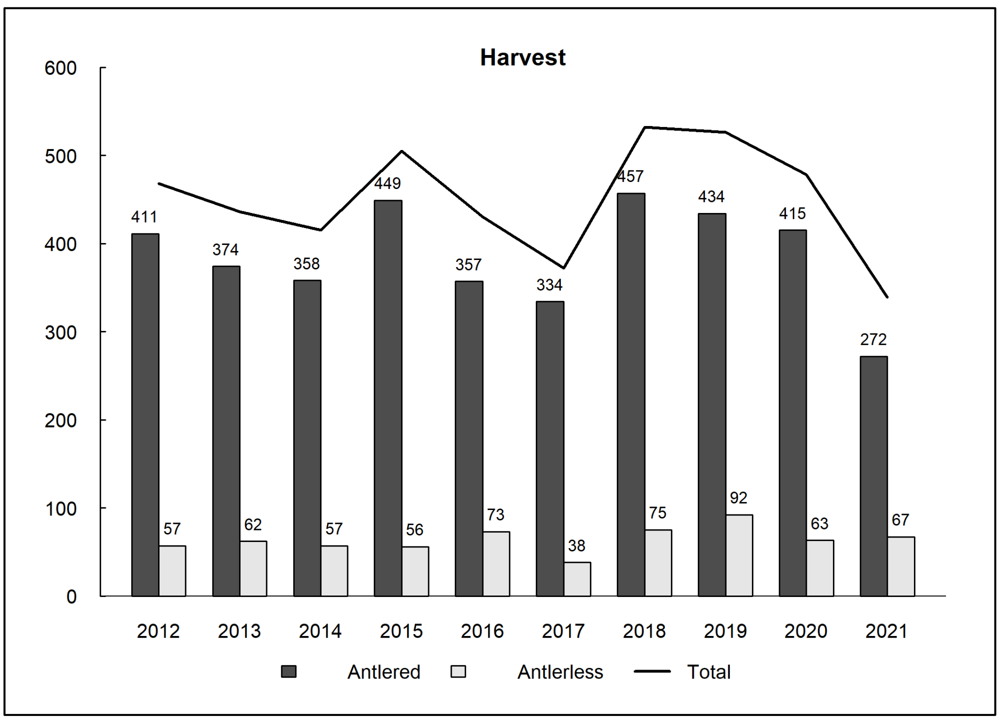

Figure 3. Estimated number of antlered and antlerless elk harvested in the Olympic elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department and during established Tribal seasons, 2012-2021. Estimates of Tribal harvest were derived from 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).

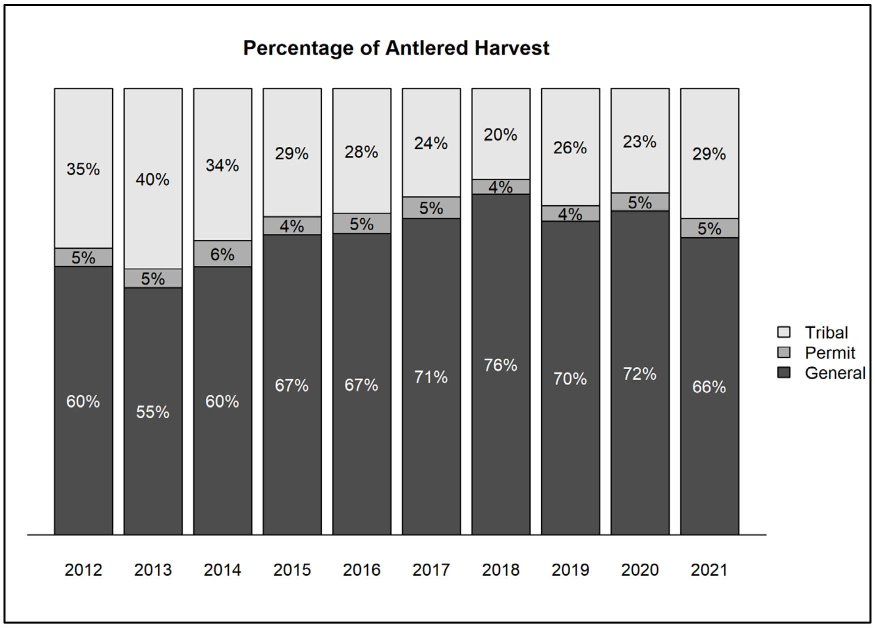

Figure 4. Estimated percentage of recreational antlered harvest in the Olympic elk herd area that occurred during general and permit seasons and the percentage of harvest that occurred during established tribal seasons, 2012-2021.

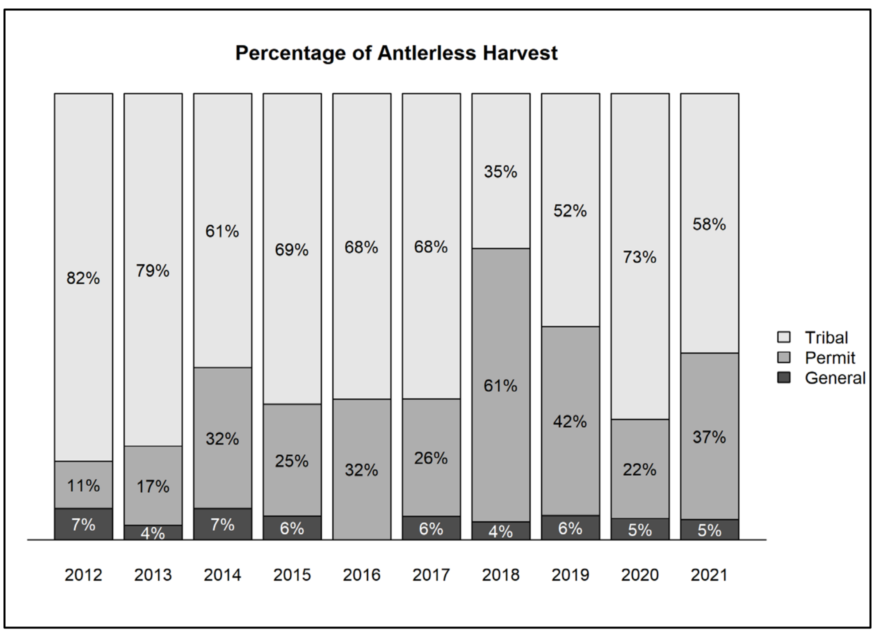

Figure 5. Estimated percentage of recreational antlerless harvest in the Olympic elk herd area that occurred during general and permit seasons and the percentage of harvest that occurred during established tribal seasons, 2012-2021.

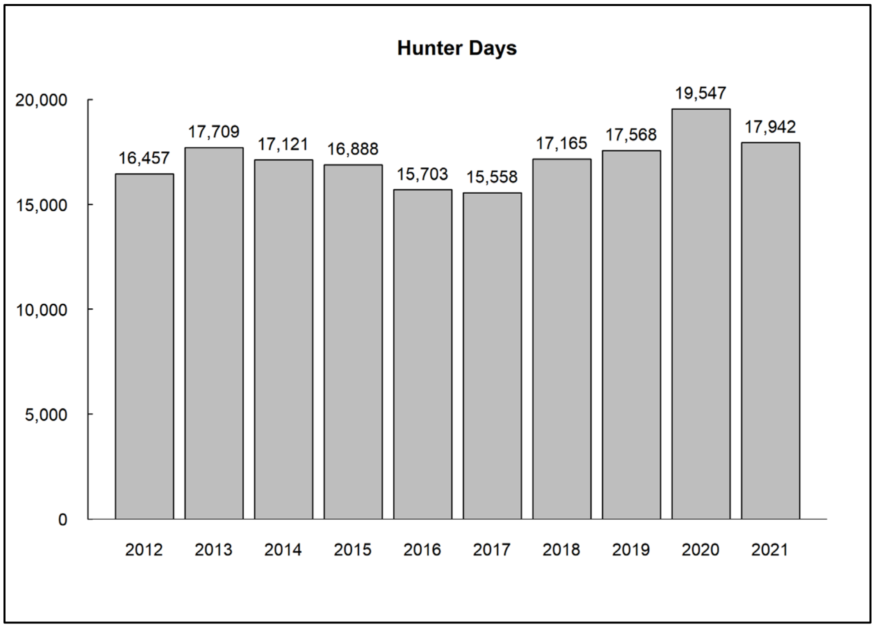

Figure 6. Estimated number of days hunters spent pursuing elk in the Olympic elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

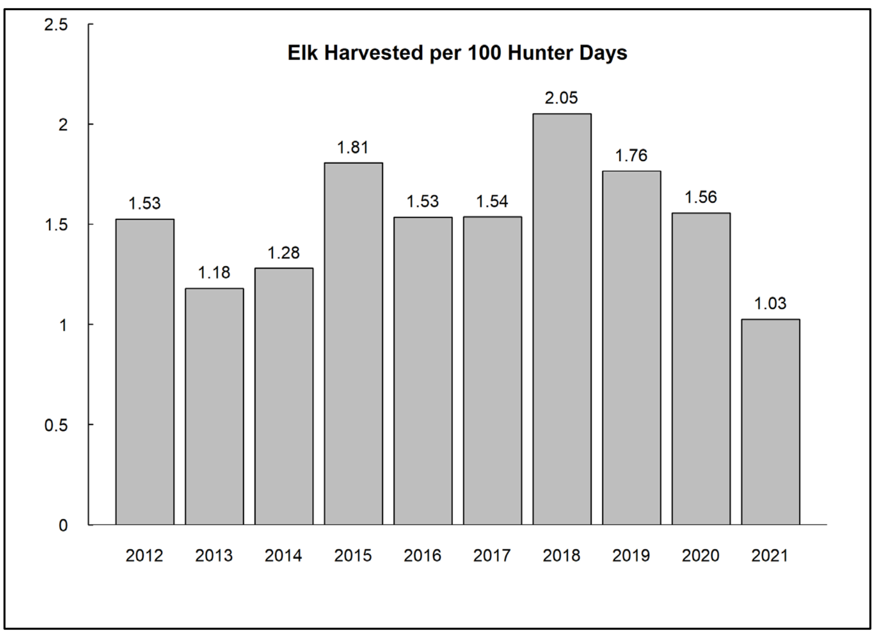

Figure 7. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the Olympic elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

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). In addition, in one study, poaching-related mortality accounted for 2.5% among bulls and cows in the Olympic herd (Smith et al., 1994).

Habitat

Franklin and Dyrness (1973 and 1988) provide a thorough description of the natural characteristics of the diverse array of habitats found in the OEH range, which extends from the coastal and inland marine ecosystems at sea level through a series of forested zones culminating at elevations well above 7,000 feet in the Olympic Mountains. At the higher elevations within ONP and USFS designated wilderness areas, elk have access to abundant, largely undisturbed habitat, including old-growth forests, river valleys, and alpine meadows (Franklin and Dyrness, 1973 and 1988; Henderson et al., 1989). Following robust timber harvest in the 1970s, management of USFS lands at mid-elevations within the herd area promoted the creation of late-seral forests. As a result, much of the USFS land on the Olympic Peninsula, once highly productive for elk, entered a phase of declining elk forage value which contributed to a reduction in elk numbers on the Olympic Peninsula following their peak in the 1980s (WDFW, 2004). Today, the application of variable-density forest thinning on USFS land is opening closed-canopy forests and improving understory plant productivity important to elk in many areas (Harrington et al., 2005; Mazza, 2009). Since 2005, Olympic National Forest has conducted commercial and pre-commercial thinning of more than 20,000 acres and nine projects specific to deer and elk forage, including invasive weed treatments, native plant seeding, and planting, meadow restoration, and slash piling (B. Howell and K. Holtrop, personal communications).

At lower elevations, commercial timber harvest has substantially changed elk habitat resulting in a patchwork of stand types and ages, each with varying degrees of value for elk (WDFW, 2004). Early seral stands, riparian zones, mature conifer, mixed forests, and remnant stands of old-growth provide the most value to elk, while stands with dense canopy cover, usually 20-40 years old, provide the least (Lopez-Perez, 2004). Burning, a once common practice that created improved forage conditions for elk following clear-cutting, has largely been replaced with herbicide spraying, which can delay or reduce plant growth for the first three years after clear-cutting (Ullapa, 2015). As such, the amount and condition of elk habitat are subject to change due to the timing and extent of forest management activities, at times entering a phase when conditions are favorable to elk and at other times conditions less favorable. Private pastureland, planted for other agricultural purposes, can also be an important component of elk habitat in many GMUs.

Forage quality and quantity affect the nutritional condition of elk (Cook, 2002) and have been identified as limiting factors affecting elk populations (Trainer, 1971; Starkey et al., 1982; Leslie et al., 1984). Inadequate forage, resulting in a lower nutritional condition, affects elk through poor body condition, repressing adult and calf survival, pregnancy rates, recruitment rates, and ultimately the ability of a population to grow (Trainer, 1971; Thorne, 1976; Cook, 2002; Cook et al., 2004). Inadequate nutrition can be limiting during any season; however, if good nutritional conditions exist during alternate seasons, animals may be able to compensate for periods of lower conditions (Cook et al., 2004). In western Washington and particularly on the Olympic Peninsula, poor forage quality or quantity may have contributed to declines in some areas (WDFW, 2004) and may be limiting productivity overall (Schwartz & Mitchell, 1945; Starkey et al., 1982; Jenkins & Starkey, 1991; Schroer et al., 1993; Jenkins & Starkey, 1996; Peek et al., 2001; Cook et al., 2014). In a comparison of elk nutritional condition and productivity, Cook et al. (2014) found that when compared to Roosevelt and Rocky Mountain elk elsewhere, coastal populations of Roosevelt elk, including the Olympic Peninsula, were subject to summer range conditions inadequate to support moderate to high body fat levels in the fall, resulting in lower pregnancy rates and calf recruitment.

Management objectives for WDFW lands in the OEH area are described in the Olympic (WDFW, 2006), North Olympic (WDFW, 2010), and South Puget Sound (WDFW, *2022*) Wildlife Area Management plans. About 2,034 acres of the Olympic Wildlife Area are managed to provide habitat for elk (WDFW, 2006). The Wynoochee Mitigation Unit of the Olympic Wildlife Area is owned by Tacoma Power but is managed by WDFW. It provides 1,030 acres of habitat to mitigate the inundation of the winter range following the construction of the Wynoochee Dam in 1976. This includes 250 acres of pasture planted to provide elk winter forage. To help reduce agricultural crop damage on adjacent private land and provide elk winter forage, the Olympic Wildlife Area also includes the 963-acre Olympic Unit and the 41-acre Anderson Homestead. Pastures on these wildlife area units are tilled, seeded, and fertilized routinely to provide forage for locally important elk groups. Although elk use occurs on Department lands elsewhere in the OEH range, management does not include specific activities associated with elk.

Climate

The Olympic Mountains and the Pacific Ocean strongly influence the climate of the herd area. Although drought-like conditions can occur during the summer, weather conditions over much of the Olympic elk herd area tend to be mild, wet, and temperate, with most precipitation falling as rain. The highest precipitation amounts fall to the west of the Olympic Mountains, while the lowest amounts fall to the east. As points of reference, the average annual precipitation in Forks is 120 inches per year, in Sequim, it is 16 inches, and in Montesano, it is 80 inches (US Climate Center data). Snow accumulations are generally low and of short duration at lower elevations, averaging less than ten inches yearly. Persistent snow accumulations greater than 18 inches are enough to hinder elk movement and can reduce access to available forage (Parker et al., 1984; Poole & Mowat, 2005). Snow accumulations can be considerable at higher elevations in the Olympic Mountain range, often enough to trigger seasonal migrations to lower elevations (Houston et al., 1990; Schroer, 1986; WDFW, unpublished data).

Human-Wildlife Interaction

Elk conflict in the Olympic elk herd area generally falls into two categories: public safety and property/crop 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 concerns involve elk near the towns of Sequim and Forks. 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). These activities intend to reduce damage, increase landowner tolerance of elk, or reduce risk to human safety by reducing the number of elk and the amount of time elk spend on these lands. Non-lethal activities involve hazing and fencing but may also include deploying traffic signs that warn drivers traveling through areas where elk routinely cross roadways. Lethal removals are conducted through permits issued to landowners, special permit hunts, or during general season hunts within a designated Elk Area. Master Hunter permits are used in areas and times designated by the Department to address elk damage. Similarly, a youth permit hunt was created in 2018, and Wildlife Conflict Specialists may also remove elk under an agency kill authority permit.

Management actions to address human-elk conflicts around Sequim began in the 1990s, as expanding urban development replaced historical or traditional elk ranges in the area. At the same time, the Sequim elk group was growing. These actions included the use of electronic traffic warning signs triggered by radio collars worn by elk; habitat enhancement work to provide alternative range; a capture and relocation of 17 elk in 1995 (Nickelson et al., 2003); numerous hazing activities; landowner compensation for crop damage or loss; and the removal of elk. Many of these activities are still utilized today.

Similar situations are emerging in Forks and Joyce, WA. In 2018, an Elk Area was created around the town of Forks (Elk Area 6612, Forks). Forty antlerless elk permits were issued each year from 2018 to 2021, and 70 hunters reported hunting during this permit hunt, resulting in a harvest of 45 elk. New for 2021, an elk area was created around the town of Joyce, and five antlerless permits were available. Four hunters reported hunting and harvesting a total of four elk, and twelve permits were issued to remove elk from the Sequim area in 2021, resulting in the harvest of five bull and four antlerless elk.

The more common human-elk conflict situation in the Olympic elk herd area is related to damage to private agricultural lands and pastures, which can create significant costs for the landowner and WDFW. For example, for 2021/22, 58 permits were issued to remove elk, and 35 elk were harvested. All were antlerless except five bulls were taken from GMU 624 near Sequim, WA (Table 1).

Table 1. The number of permits issued associated with conflict reduction activities and elk removed in 2020/21 for Game Management Units (GMU) in the Olympic elk herd area; all but 5 bulls taken from GMU 624 were antlerless elk.

GMU	Permits Issued	Elk Removed
603	8	6
607	4	0
615	3	2
624	12	9
636	8	5
642	1	0
648	12	5
651	10	8
Total	**58**	**35**

Management Concerns

The Olympic Elk Herd Plan (WDFW, 2004), which provides management objectives and guidance for the monitoring, is currently being updated. A formalized monitoring strategy is under development as the herd plan is updated. Hunting harvest data and herd composition surveys, including information collected by the Olympic Peninsula Treaty Tribes, provide the basis for management decisions related to the Olympic elk herd. Monitoring during this interim period has increased to include additional GMUs, but better coverage is desired. Calf-to-cow ratios frequently at or below desired levels needed to increase the elk population remain a concern and support a conservative harvest strategy, particularly among antlerless elk. Treponeme-associated hoof disease (TAHD) spreading to new places in the Olympic elk herd area may present additional challenges related to managing this herd.

Management Conclusions

Post-season (Spring) bull-to-cow ratio objectives are usually met. Calf-to-cow ratios are frequently at or below desired levels needed to increase the elk population. However, conservative harvest strategies remain important for the management of this herd, although some areas with human-elk conflict may need a different approach.

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Selkirk Elk Herd

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Introduction

The Selkirk elk herd is located in northeast Washington and includes the Pend Oreille and Spokane subherds. The Pend Oreille subherd consists of nine 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 subherd consists of six GMUs, including GMUs 127 (Mica Peak), 130 (Cheney), 133 (Roosevelt), 136 (Harrington), 139 (Steptoe), and 142 (Almota) (Figure 1).

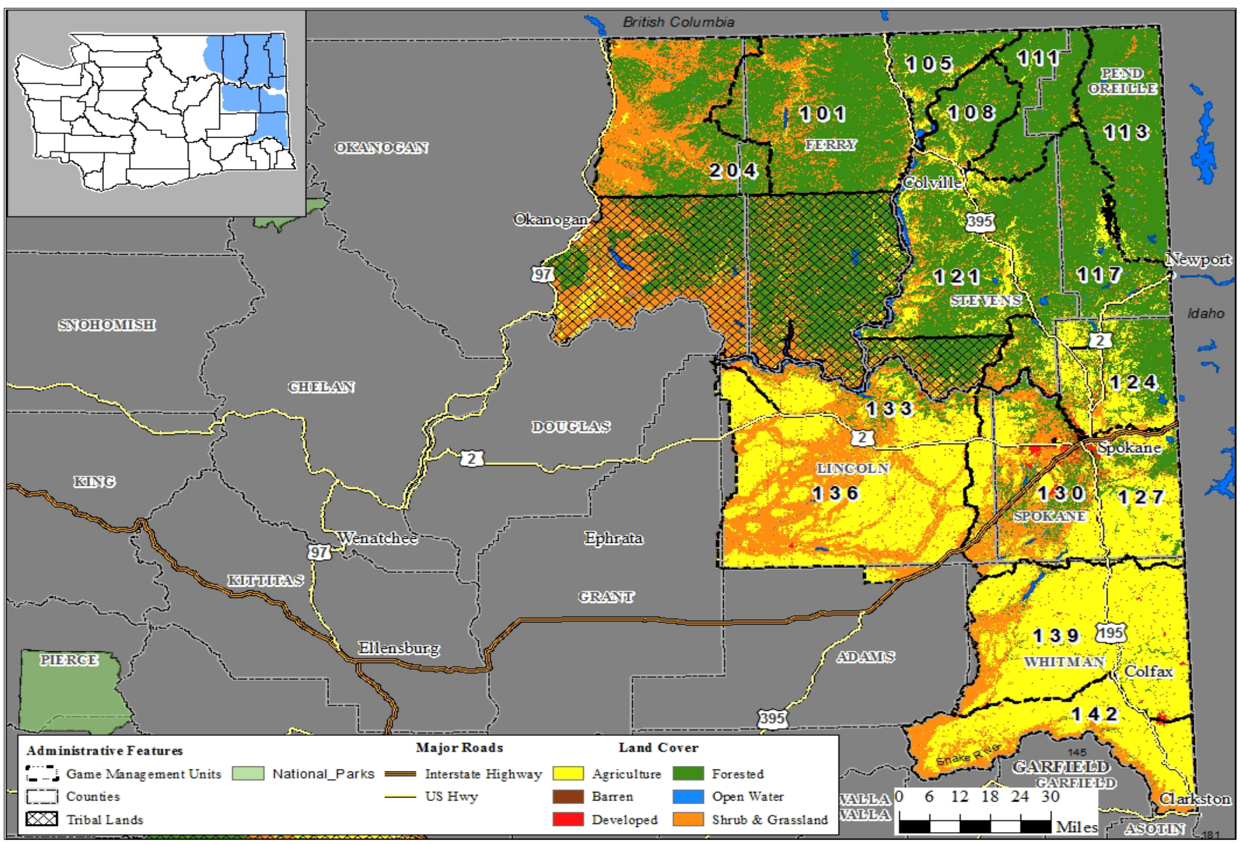

Figure 1. Dominant land use cover types within the 15 game management units that comprise the Selkirk elk herd area.

Management Guidelines and Objectives

The Department's objective is to increase elk abundance in the Pend Oreille subherd area to 1,500-2,500 elk and to maintain 1,000-1,500 elk in the Spokane subherd 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 subherd 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 widespread surveys to monitor the Pend Oreille subherd.

Since the winter of 2017/18, the Department has used radio collars deployed on cow elk within GMUs 117 and 121 to conduct helicopter surveys of groups with collared elk and record calf-to-cow ratios. 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. WDFW conducted no aerial surveys in 2020 because of COVID-19. In 2021, the Spokane Tribe conducted an aerial survey in March and counted 642 elk with a calf:cow ratio of 19 calves per 100 cows.

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 subherd area. However, these surveys only include a small portion of the Spokane subherd and are likely to represent only some of the subherd. The number of elk observed during these surveys since 2006 has ranged from 154–460 elk and varies annually (Figure 2). After 2020 surveys were switched from annual to once every three years. The decline observed in this population from 2010 to 2018 results from a concerted effort by WDFW and TNWR to reduce the local population due to elk suppression of aspen regeneration on the refuge. This reduction was accomplished through limited-entry antlerless hunts on TNWR that resulted in direct mortalities and moving animals out of the survey area. The increase observed in the past three years is likely a result of elk figuring out the locations on and off TNWR where hunting is not allowed. Estimated calf:cow ratios have been relatively stable to increasing (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 subherd area are for any bull. Most opportunities to harvest antlerless elk are limited, special permit opportunities. However, opportunities to harvest antlerless elk do occur throughout the subherd 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 total harvest (general and permit opportunities combined) within the Pend Oreille subherd have averaged 325 elk between 2012-2021 and increased in 2021 (Figure 5). Nearly all bull harvests (Figure 6) and most antlerless harvests (Figure 7) occur during general seasons. Hunter effort decreased in 2021 and catch per unit effort (CPUE) has varied annually within the subherd since 2012 (Figures 8-9).

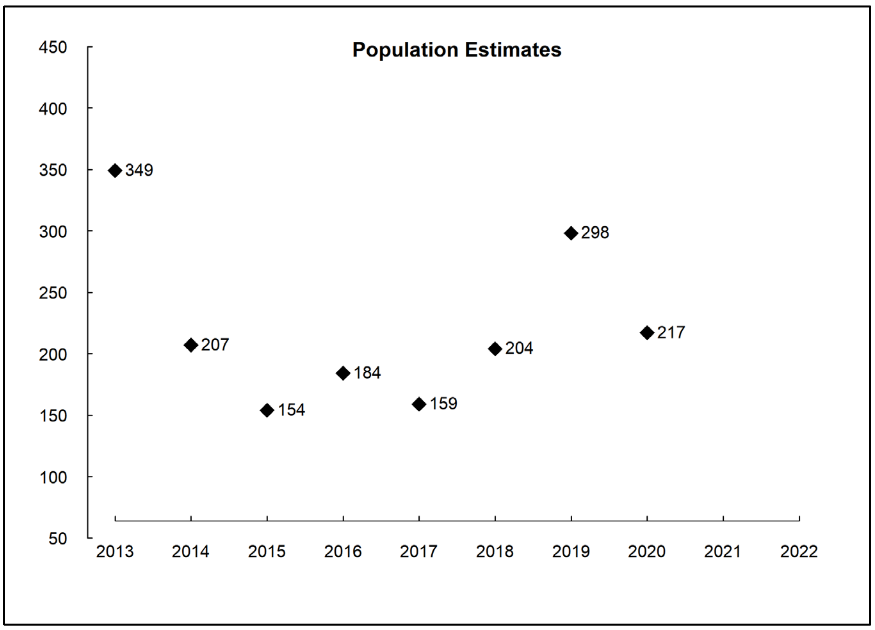

Figure 2. Number of elk observed during aerial composition surveys in autumn on the Turnbull National Wildlife Refuge, autumn 2013-2022. No survey was conducted in 2021 or 2022.

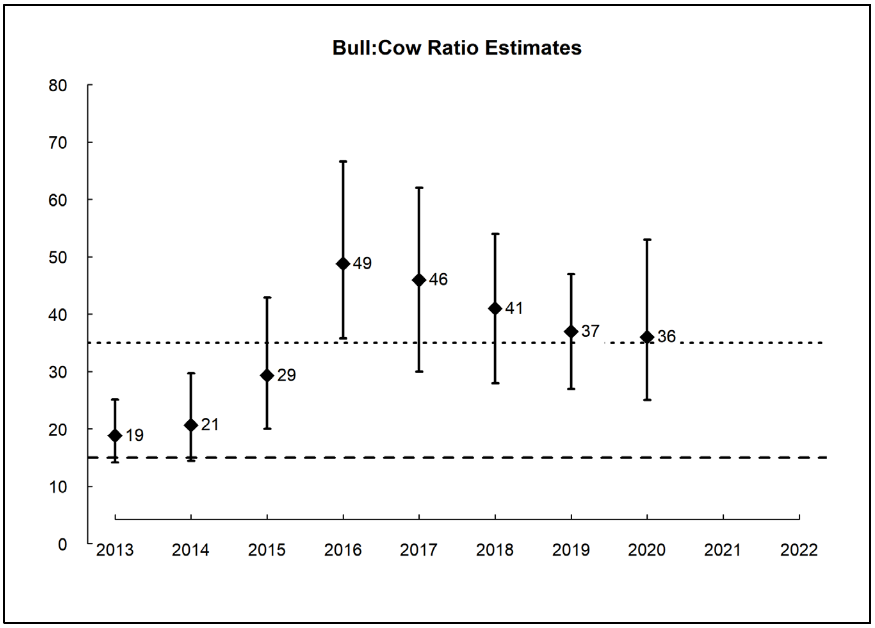

Figure 3. Estimates and associated 95% confidence intervals of pre-hunt bull:cow ratios on the Turnbull National Wildlife Refuge, autumn 2013-2022. No survey was conducted in 2021 or 2022. The dashed lines represent the objective range of 15-35 bulls:100 cows.

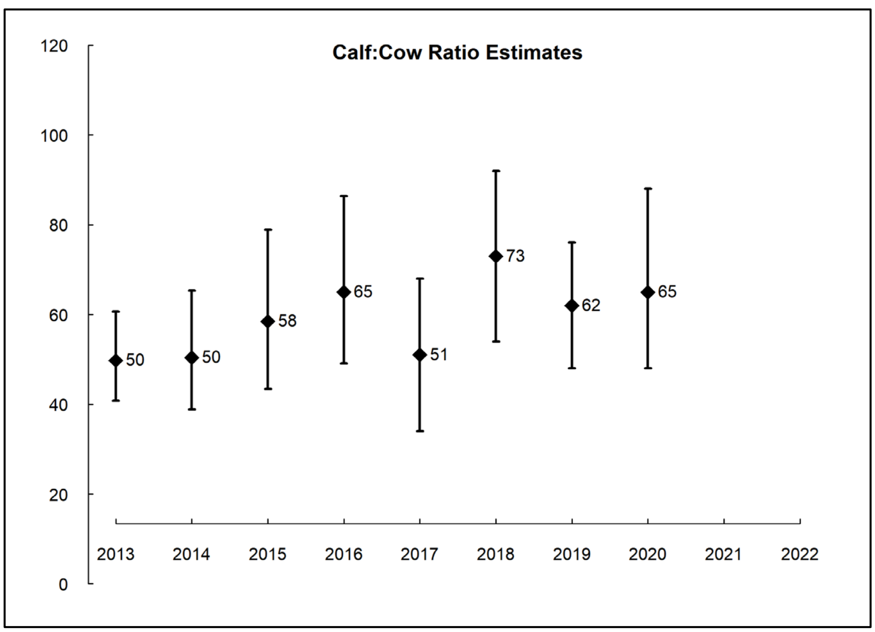

Figure 4. Estimates and associated 95% confidence intervals of pre-hunt calf:cow ratios on the Turnbull National Wildlife Refuge, autumn 2013-2022. No survey was conducted in 2021 or 2022.

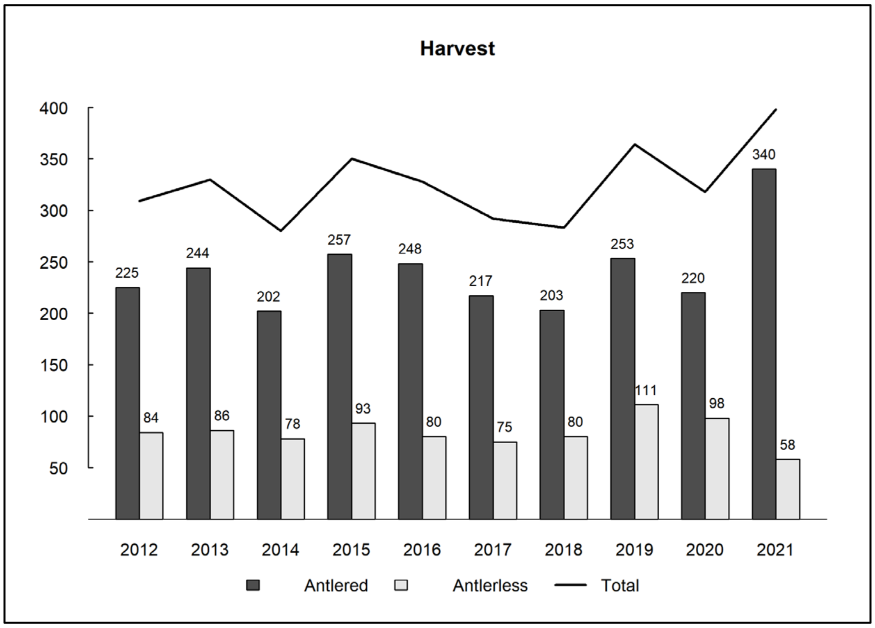

Figure 5. Estimated number of antlered and antlerless elk harvested in the Pend-Oreille subherd area during recreational hunting seasons (general and permit opportunities combined) established by the Department, 2012-2021. Estimates do not include elk harvested in association with damage permits (see Human-Wildlife Interaction below). Estimates also do not include harvest that occurred during established Tribal seasons because that data is currently not available.

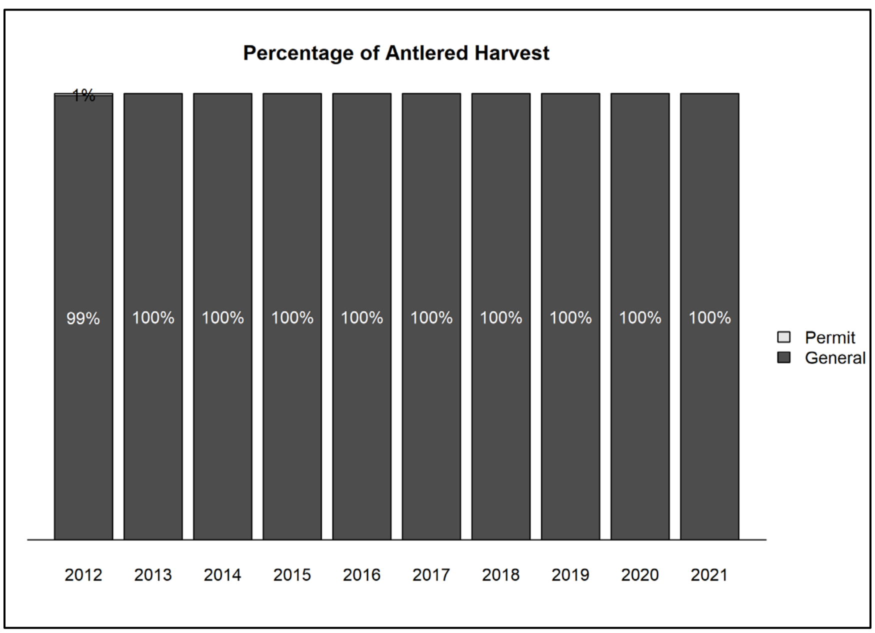

Figure 6. Estimated percentage of recreational antlered harvest in the Pend-Oreille subherd area that occurred during general and permit seasons, 2012-2021.

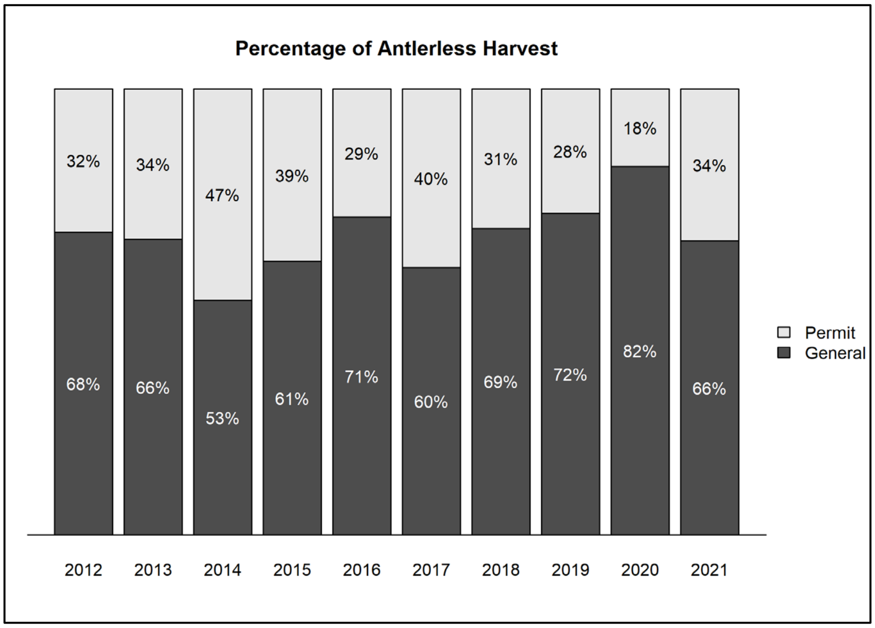

Figure 7. Estimated percentage of recreational antlerless harvest in the Pend-Oreille subherd area that occurred during general and permit seasons, 2012-2021.

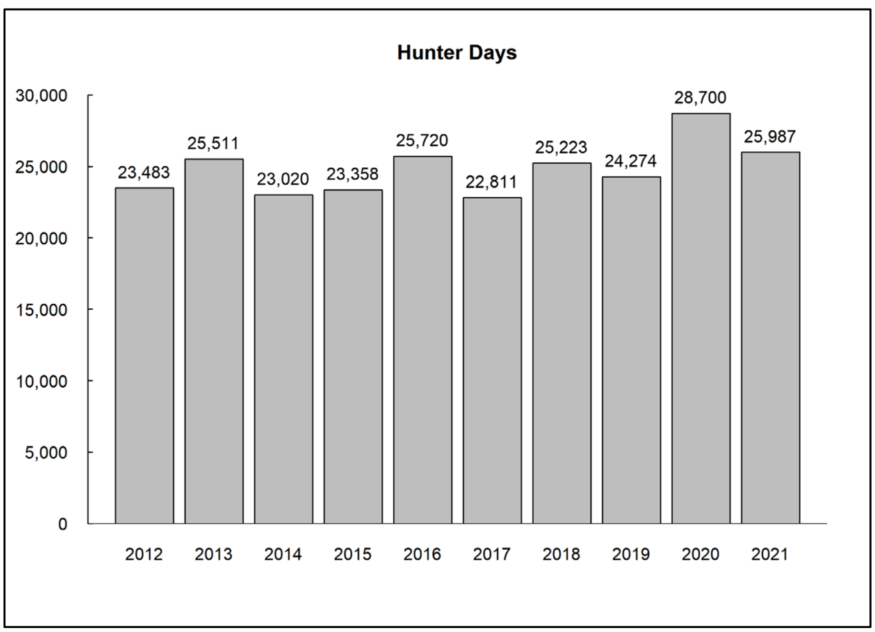

Figure 8. Estimated number of days hunters spent pursuing elk in the Pend-Oreille subherd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

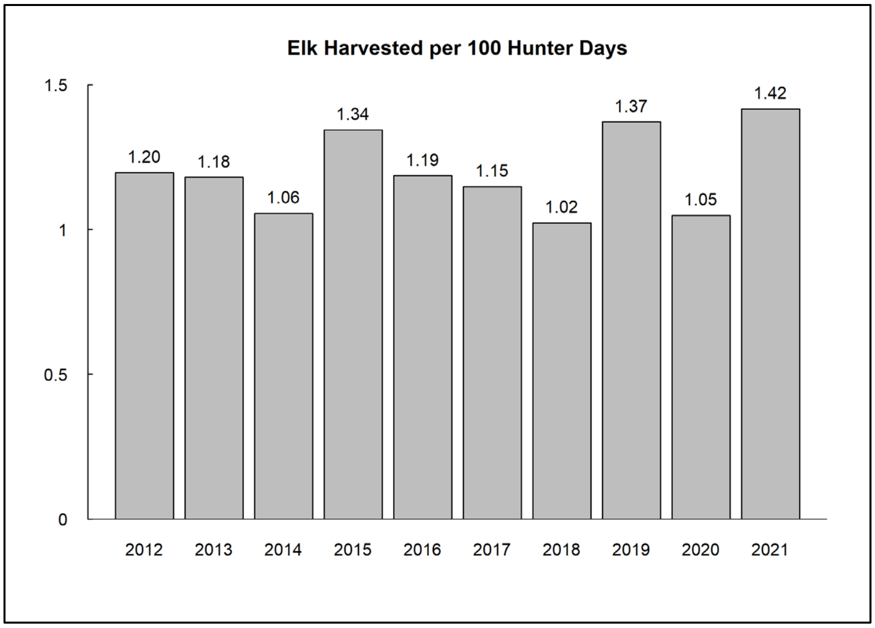

Figure 9. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the Pend-Oreille subherd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

The Department allows the harvest of any elk during all general seasons in the Spokane subherd area and collaborates with the USFWS to implement special permit harvest opportunities on TNWR. Estimates during general seasons and total harvest in the Spokane subherd area averaged 248 and 261 elk, respectively, for 2012-2021 (Figure 10). In the Spokane subherd, most elk are harvested during general seasons (Figures 11 & 12). Harvest estimates (Figure 10), hunter effort (Figure 13), and CPUE (Figure 14) vary annually in this subherd. Much of this variation reflects access to private lands and the patchy distribution of elk rather than true variation in the elk population.

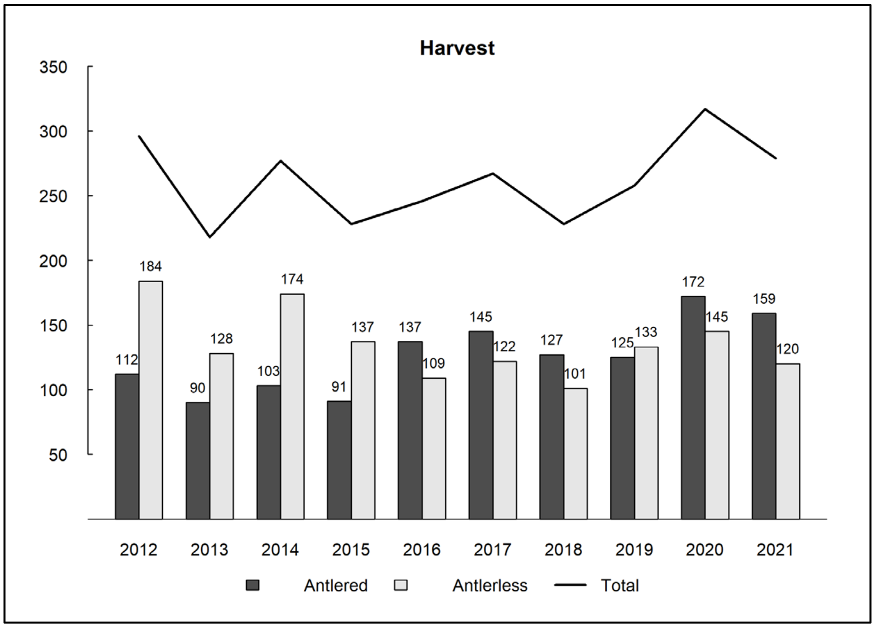

Figure 10. Estimated number of antlered and antlerless elk harvested in the Spokane subherd area during recreational hunting seasons (general and permit opportunities combined) established by the Department, 2012-2021. Estimates do not include elk harvested in association with damage permits (see Human-Wildlife Interaction below). Estimates also do not include harvest that occurred during established Tribal seasons because that data is currently not available.

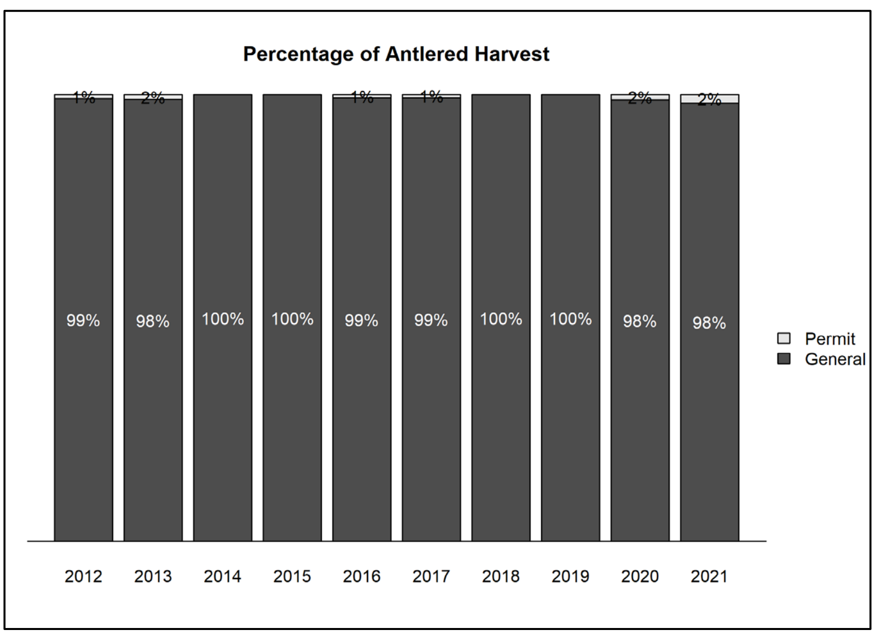

Figure 11. Estimated percentage of recreational antlered harvest in the Spokane subherd area that occurred during general and permit seasons, 2012-2021.

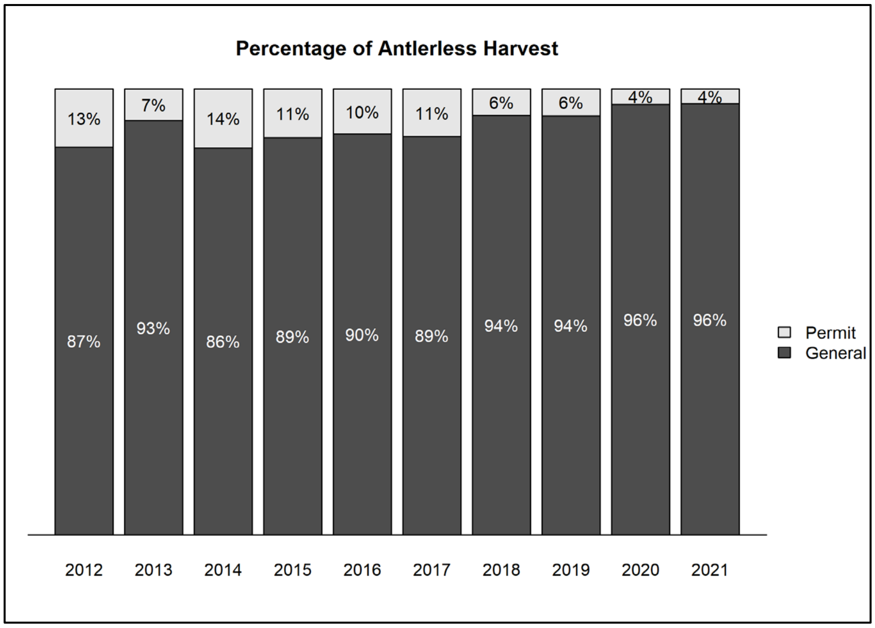

Figure 12. Estimated percentage of recreational antlerless harvest in the Spokane subherd area that occurred during general and permit seasons, 2012-2021.

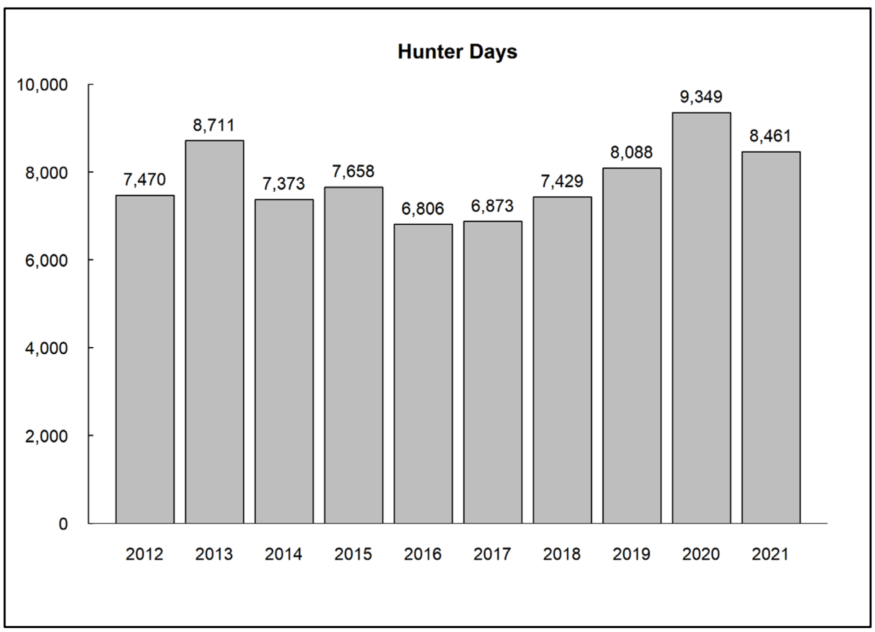

Figure 13. Estimated number of days hunters spent pursuing elk in the Spokane subherd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

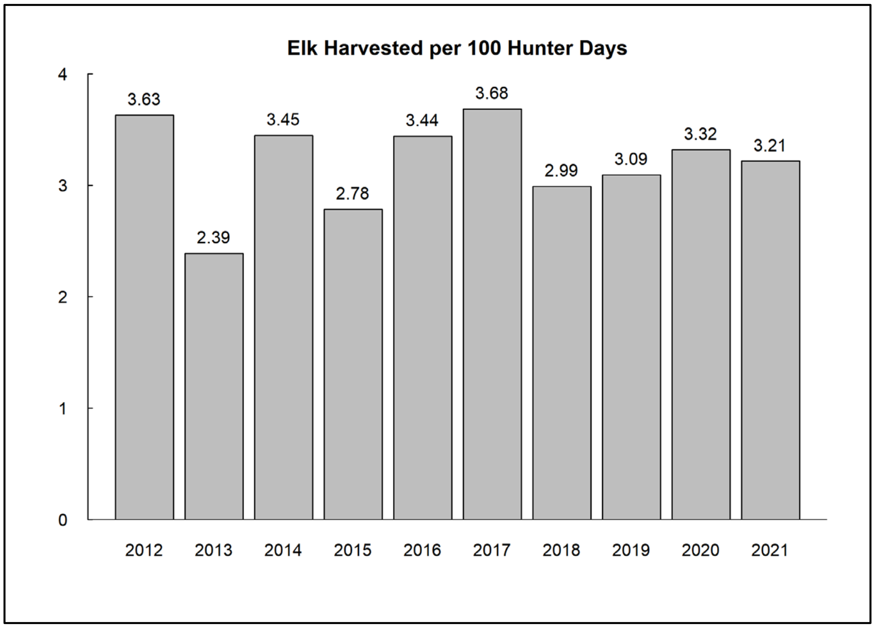

Figure 14. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the Spokane subherd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

Survival and Mortality

Common predators throughout the Pend Oreille subherd area include black bears, cougars, and gray wolves. Initial results from a Department research project (WDFW/UW Predator-Prey Project) indicate human-caused mortality is the leading cause of mortality for cow elk within the Pend Oreille subherd.

Black bears and cougars also occur throughout the Spokane subherd area. Habitat conditions and hunter harvest suggest that bear and cougar numbers are likely higher north of the Spokane River in the Pend Oreille subherd area than in the Spokane subherd 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 subherd area (WDFW et al., 2022).

Although the Department has never documented any increased mortality events, severe winter events do occur within the Pend Oreille and Spokane subherd 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 subherd area, which has the potential to reduce the availability of high-quality forages that elk rely on to accrue adequate fat stores for winter. Extreme conditions can affect adult survival directly but are more likely to have a population impact via reduced calf recruitment.

Obtaining elk survival estimates and causes of mortality for the Pend Oreille subherd is one goal of the predator-prey project (see research section). Data collection has ceased, and survival estimates will be available in next year's report. As a result, there have been no comprehensive efforts to monitor the survival of elk in the Spokane subherd area.

Habitat

Timber harvest is common on state forest lands and even more intensive on private lands. Timber harvest is limited on federal forests. Logging potentially benefits the Pend Oreille subherd 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 in the WDFW Chesaw Wildlife Area within the Pend Oreille subherd area. Over 350,000 acres within the Pend Oreille subherd area were burned by wildfires in the summer of 2015, and approximately 10,601 more acres were 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 subherd 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, social tolerance within agricultural and suburban areas will likely limit the growth and expansion of the Spokane subherd.

Human-Wildlife Interaction

Most elk conflict is restricted to the lower-elevation agriculture lands in the Pend Oreille subherd. In 2021, 37 damage prevention permits and 41 kill permits were issued to landowners experiencing agricultural damage within GMUs 101, 111, 113, 117, 121, and 204. The reported harvest was 32, and all permits issued were for antlerless elk only. WDFW modified hunting regulations for GMU 204 in 2016 to allow Early Archery while Late Muzzleloader season was switched to Early Muzzleloader to match the rest of the subherd 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. Forty-eight damage permits and 11 kill permits were issued to private landowners enrolled in the Damage Prevention Cooperative Agreement (DPCA) Program for elk in GMUs 124-142 in 2021. The reported harvest on those permits was 10 for damage permits and 0 for kill permits. Occasionally, Master Hunter Damage Permits are also utilized to address damage outside of the general hunting season for landowners who are 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 were attempting to capture and radio-collar at least 50 elk and 65 white-tailed deer in NE Washington, 100 mule deer in the Okanogan, and ten 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 continued during the winters of 2018 and 2019. Over the course of the capture efforts, 63 elk were collared. During March of 2018 and 2019, WDFW biologists conducted aerial composition surveys by locating cows collared as part of the project. See the survey section for these results.

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.

WDFW created the special permit hunt on TNWR to address habitat damage by elk on the Turnbull Refuge. Elk counts from annual aerial surveys in the Turnbull area have shown a considerable decline since the high observed in 2010. However, reported sightings and damage complaints to agricultural crops in the area suggest this is due in part to the movement of elk out of the area in response to drought and hunting pressure rather than a true population decline. Counts increased in 2018 and 2019, as spotters found groups of elk in areas where they are infrequently observed in the survey area. In response to frequent reports of a large elk herd a few miles south of the survey area, new survey units were added there in 2020, and 141 additional elk were observed (not included in Figure 2 totals for 2020). It is unknown if or how elk from this group use TNWR, and 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 stable or slightly increasing within the Pend Oreille subherd area. However, recent wildfires will likely improve habitat conditions that favor elk.

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

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South Rainier Elk Herd

ERIC HOLMAN, Wildlife Biologist

Introduction

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

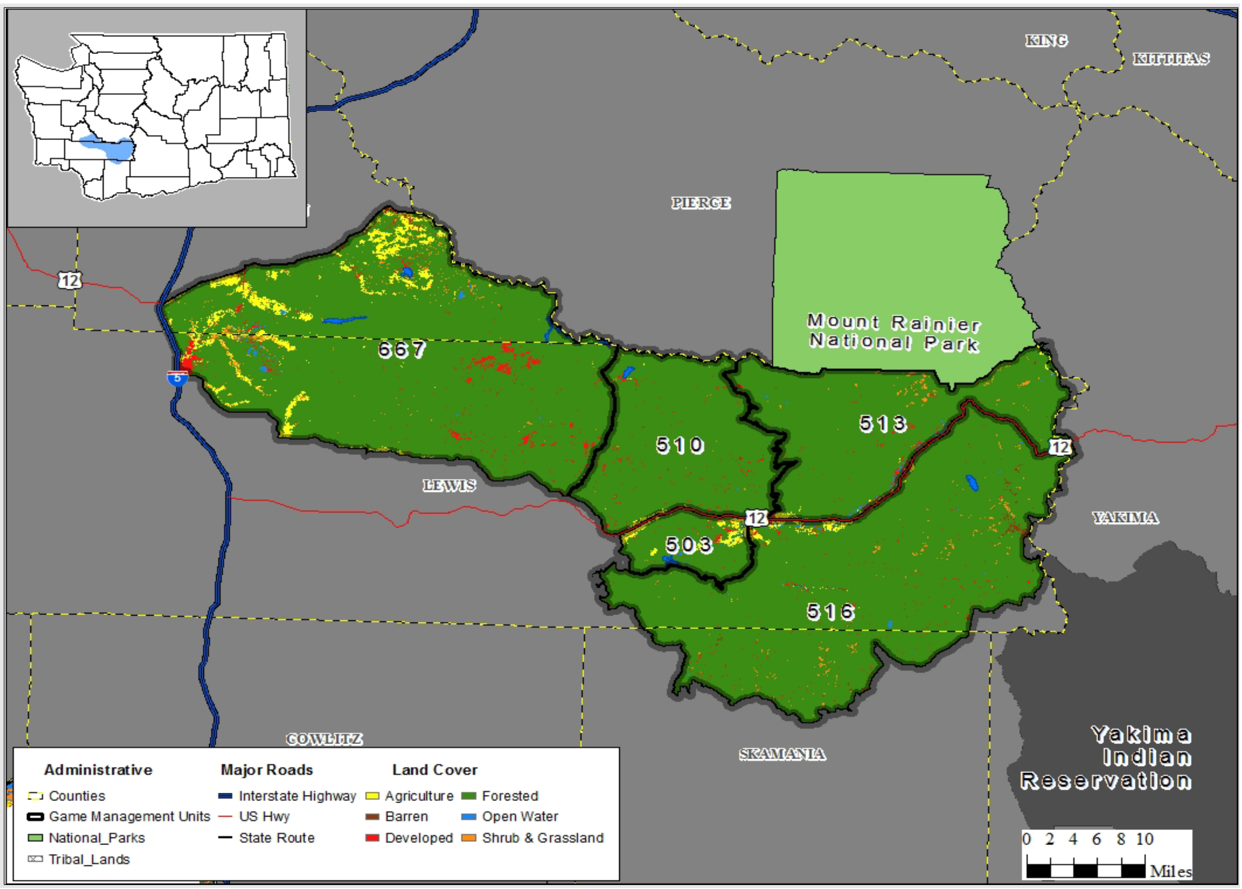

Figure 1. Dominant land use cover types within the five game management units that comprise the South Rainier elk herd area.

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 revision, and management objectives may need to be updated. In addition, the Department still needs to identify a formalized monitoring strategy to estimate elk abundance and herd composition in the South Rainier elk herd area. Because the Department has yet to identify a comprehensive monitoring strategy representative of the entire herd, biologists primarily depend on harvest data to make inferences about population trends.

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 specifically for that area (Gilbert & Moeller, 2008). The surveys in early spring include portions of GMUs 503, 510, 513, and 516. The results of these surveys are illustrated in Figure 2 (Moeller, 2022).

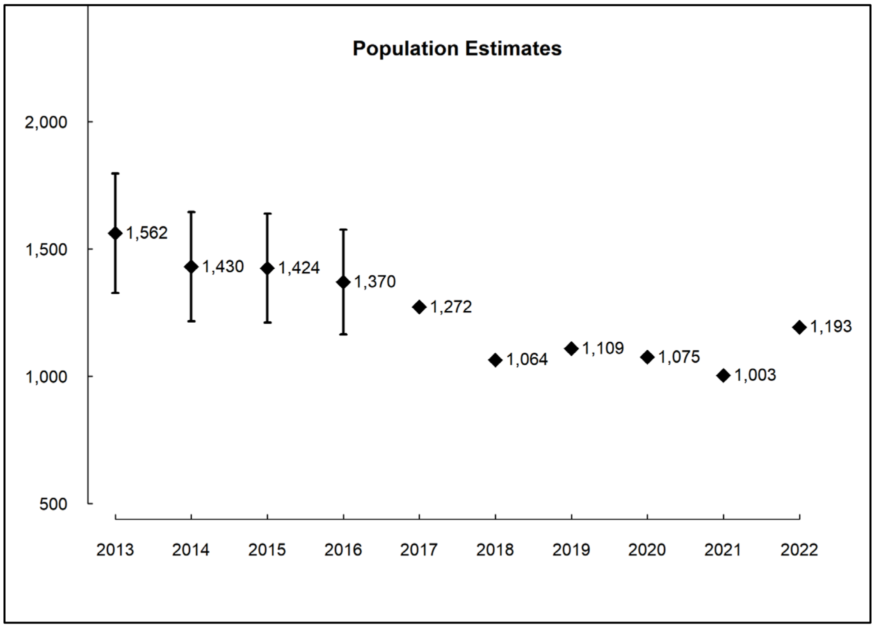

Figure 2. Sightability corrected estimates of total elk abundance in the Cowlitz River Basin (portions of GMUs 503, 510, 513, and 516), spring 2013-2022. Data are collected and provided by the Puyallup Tribe of Indians.

The Department has also collaborated with the Muckleshoot Indian Tribe, the U.S. Geological Survey, National Park Service, and the Puyallup Tribe of Indians to estimate elk abundance in the high alpine meadows of Mount Rainier National Park (MRNP) (Griffin 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 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 periodically conducted surveys on the Centralia Mine portion of GMU 667 since 2010. The survey was completed in August 2021. The effort resulted in observations of 267 elk with a bull:cow ratio of 34:100 and a calf:cow ratio of 38:100.

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 occur during 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 total annual harvest during State and Tribal seasons have averaged 366 elk during 2012-2021. However, harvest estimates have slowly declined over this 10-year period (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 efforts were stable during 2012-2021 (Figure 6). Estimates of hunter success (expressed as catch per unit effort; CPUE) have been stable from 2012 to 2021 (Figure 7).

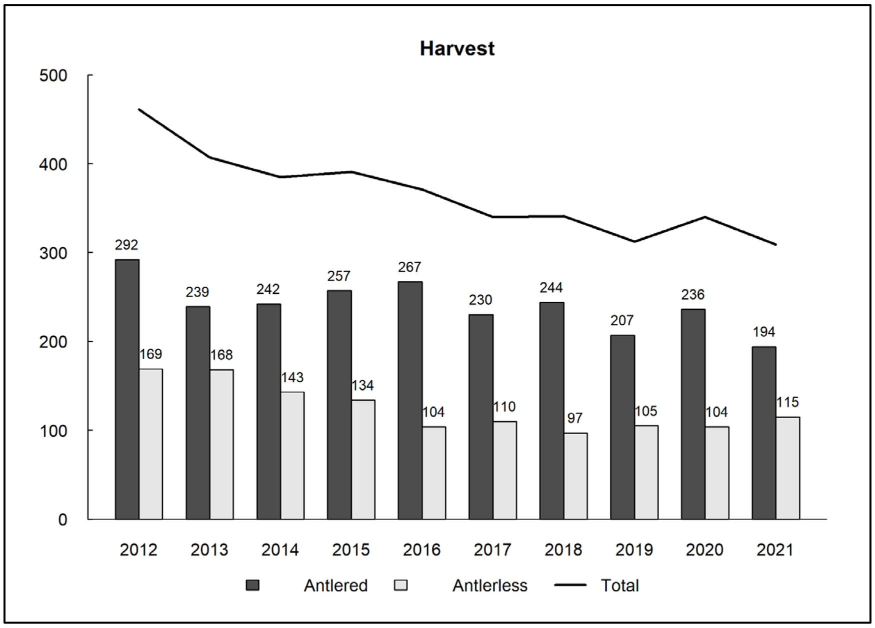

Figure 3. Estimated number of antlered and antlerless elk harvested in the South Rainier elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department and during established Tribal seasons, 2012-2021. Estimates of Tribal harvest were derived 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).

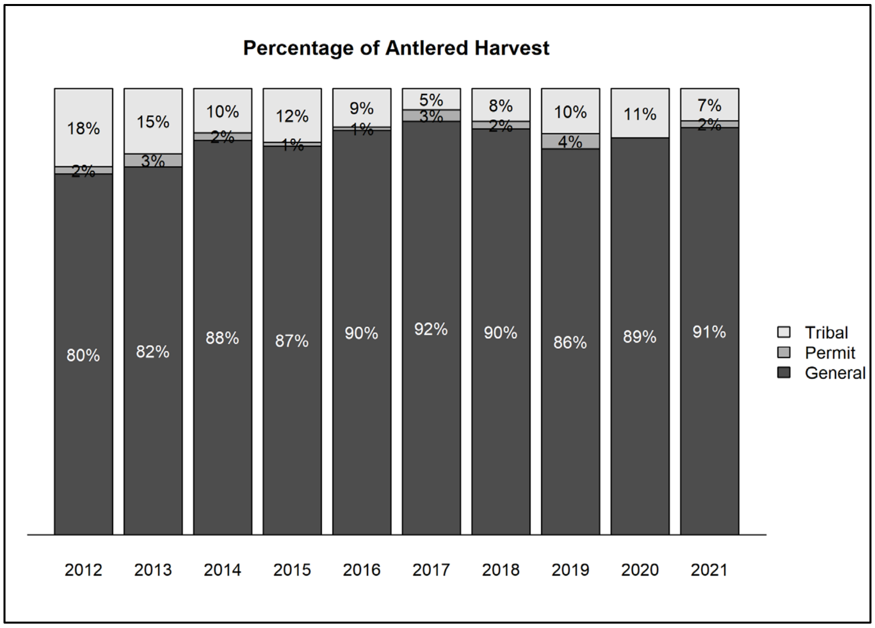

Figure 4. Estimated percentage of recreational antlered harvest in the South Rainier elk herd area that occurred during general and permit seasons and the percentage of harvest that occurred during established tribal seasons, 2012-2021.

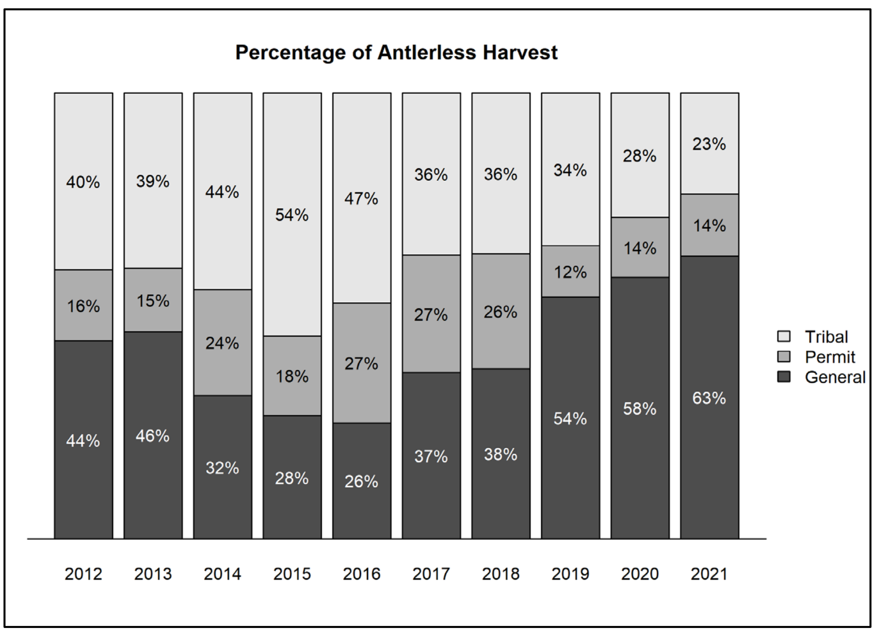

Figure 5. Estimated percentage of recreational antlerless harvest in the South Rainier elk herd area that occurred during general and permit seasons and the percentage of harvest that occurred during established tribal seasons, 2012-2021.

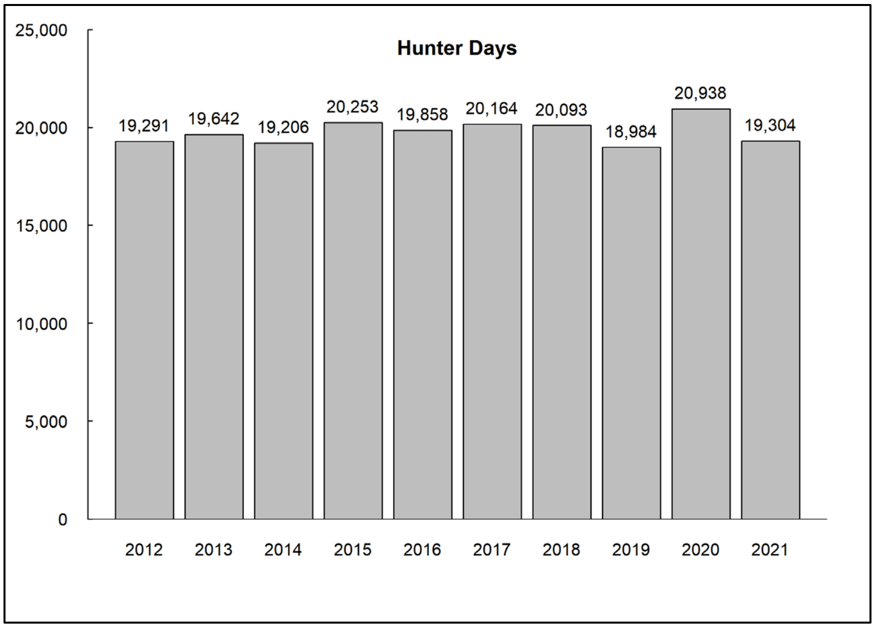

Figure 6. Estimated number of days hunters spent pursuing elk in the South Rainier elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

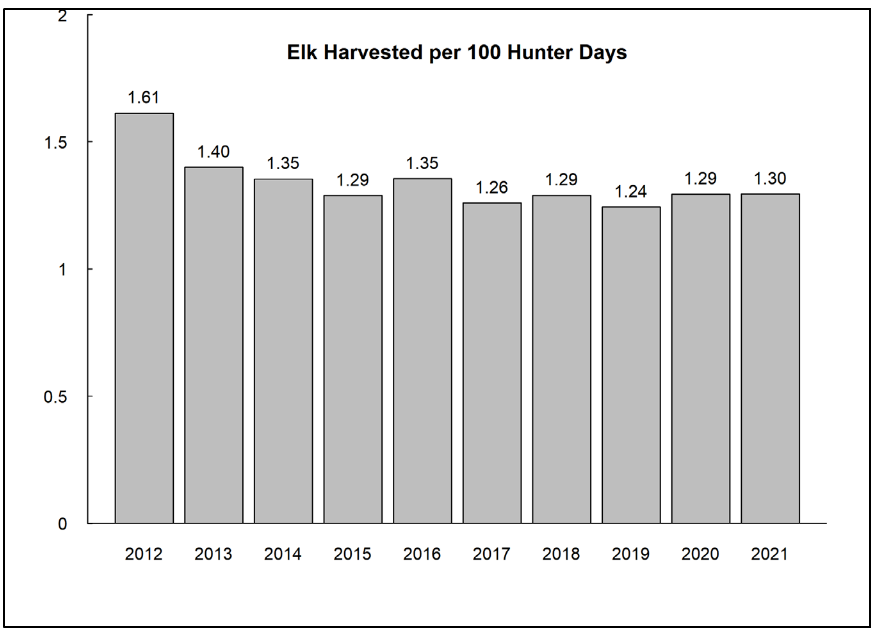

Figure 7. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the South Rainier elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

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.,2022), although wolf sightings are being investigated (M. Tirhi, pers. comm.).

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

There have been no recent studies to monitor the survival of elk in the South Rainier elk herd area.

Habitat

Most 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 parkland, agricultural areas, and suburban/rural residential land use. The herd continues to benefit from creating early seral habitats on private industrial and DNR forests.

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 forests. 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 increase or improve elk habitat purposefully. Additionally, intensive forest management practices, including planting dense stands of fast-growing conifer seedlings and applying herbicides during the 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 these varying factors is that the best quality and most quantity of favorable forage occurs approximately 3 to 14 years after timber harvest, whether herbicide treatments are applied or not. However, the differences between available, favorable forage 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 WDFW refers 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. Additional thinning is planned for this area.

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 a 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, 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 take of elk causing agricultural damage in the South Rainier elk herd area during 2021-22. 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 to haze elk from the area.

Table 1. Number of DPCA'S (Damage Prevention Cooperative Agreements), Permits to lethally remove elk causing damage to agricultural crops and resulting number of elk removed, South Rainier elk herd, 2021-2022.

GMU	DPCAs	Landowner Permits	Public Permits	Total Permits	Total Elk Removed
503	1	2	4*	6	5
513	2	5	0	5	1
516	4	2	3*	5	4
667	6	8	0	8	4
TOTAL	**13**	**17**	**7***	**24**	**14**

*** A total of 7 permits were deployed to hunt in either 503 or 516.**

In addition to conflicts with agriculture, elk in the Upper Cowlitz River Valley are regularly near 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 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 between 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 reduced survival or reproductive potential probability. 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 researching to estimate the distribution and prevalence of TAHD better. 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 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 projects 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. The fee-based system restricts access to these lands and has continued in the years that have followed. The ramifications of this limited access to elk hunting opportunities are difficult to quantify as the landowners do not own entire Game Management Units, some individuals elect to pay the access fee, some elect to hunt in another area, and some may decide to quit hunting. The effects of reduced hunter access and participation are twofold in that it impacts the Department's goals to maximize recreational access to wildlife. It likely reduces hunter participation and recruitment, undermining the capacity to manage elk and other wildlife.

Conflict with Agricultural Land Uses in the Upper Cowlitz River Valley

The conflict between agricultural land uses and elk in the Upper Cowlitz River Valley is likely to continue in the near term. The proximity of relatively abundant elk on forestlands surrounding the valley with attractive food resources within the valley likely guarantees that these conflicts will continue. Furthermore, large-scale habitat changes such as forest fires or extensive timber harvest on 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, has 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 are not available. Moreover, even if funding were available, installing large-scale fencing would restrict wildlife movement, require maintenance, and be aesthetically unappealing.

Management Conclusions

Harvest data, spring surveys conducted by the Puyallup Tribe of Indians, and surveys of alpine habitats on the south side of Mt. Rainier National Park indicate a slow decline in the elk population. While none of these methods provides a comprehensive index of elk abundance in the South Rainier herd area, they serve as a surrogate means of monitoring the population. Nonetheless, the 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 could impact elk in the South Rainier herd area. The extent of the disease in the South Rainier herd area is unknown, 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 20 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 address wildlife-human conflicts specifically. Finally, the existing plan prescribes an elk population goal of 3,000, but no method is currently available to monitor the entire population.

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Personal Communications

Michelle Tirhi, WDFW District Wildlife Biologist, Pierce, Thurston and Northern Lewis counties.

Willapa Hills Elk Herd

ANTHONY NOVACK AND ERIC HOLMAN, Wildlife Biologists

Introduction

The Willapa Hills elk herd is located in southwest Washington. It consists of 12 GMUs (Figure 1), including 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. GMU boundaries with county lines, and public lands within 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 of 15-35 bulls:100 cows or a post-hunt population of 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 needed a more formalized sampling design and accounted for biases commonly associated with observing elk in densely vegetated habitats (Samuel et al., 1987). Consequently, estimated ratios did not reflect 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 did not conduct elk survey flights during the spring of 2022 due to COVID restrictions. The most recent surveys were conducted during March 2020 in the southern half of the Willapa Hills Elk herd area in portions of GMUs 506, 530, 673, and 681. Researchers observed 1,524 elk during the survey. The total estimated elk abundance for this southern portion of the herd area was 2,984 (95% CI =2,546-3.688) (Figure 2). Observed bull-to-cow ratios averaged 17 bulls per 100 cows (95% CI=14-21)(Figure 3). This 17:100 statistic is well above the minimum management objective of 12 bulls per 100 cows. Mature bulls carrying antlers with five points or more were uncommon. Calf-to-cow ratios measured 34 calves per 100 cows (95% CI =29-40) (Figure 4). This calf ratio indicates good calf recruitment. 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 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 above the management objective of 12–20 bulls per 100 cows. Calf-to-cow ratios measured 45 calves per 100 cows (95% CI = 34-55). This calf ratio indicates excellent calf recruitment. Mature bulls carrying antlers with five points or more were uncommon (<10% of the total).

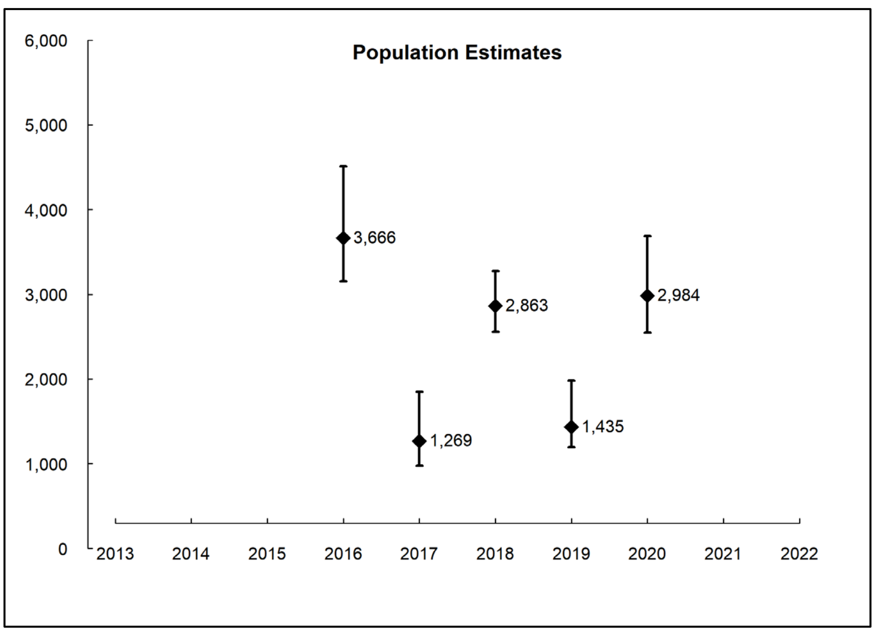

Figure 2. Estimates and associated 95% confidence intervals for elk in surveyed portions of South Willapa survey area (GMUs 506, 530, 673, and 681) in 2013, 2014, 2016, 2018, 2020 and from the North Willapa survey area (GMUs 501, 658, 660, and 672) in 2015, 2017, and 2019. WDFW did not survey the north or south survey areas in 2021 or 2022.

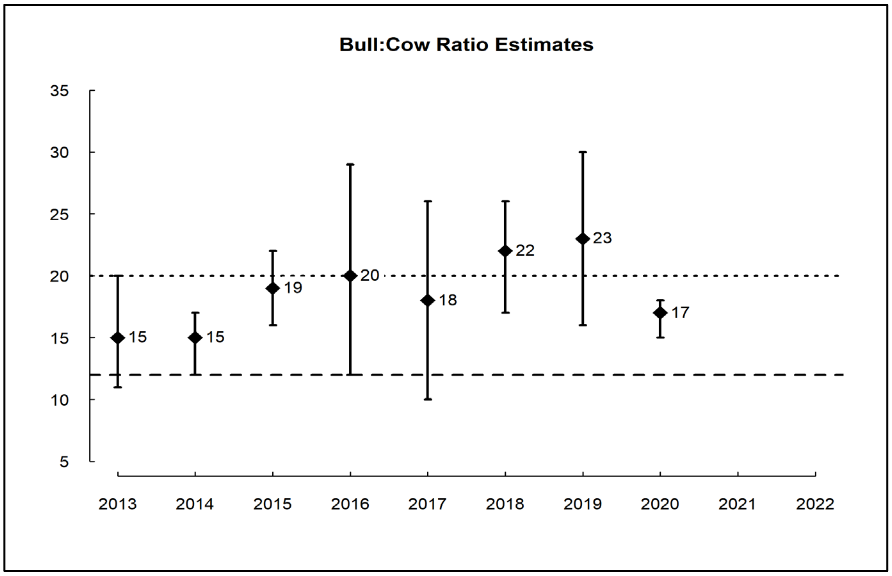

Figure 3. Estimates and associated 95% confidence intervals of post-hunt bull:cow ratios in the Willapa Hills elk herd area, spring 2013-2022. (Note - no surveys conducted in 2021 or 2022) The dashed lines represent the objective range of 12-20 bulls:100 cows. Post-hunt ratios were not comprehensively 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, 2018, 2020 and from the North Willapa survey area (GMUs 501, 658, 660, and 672) in 2015, 2017, and 2019.

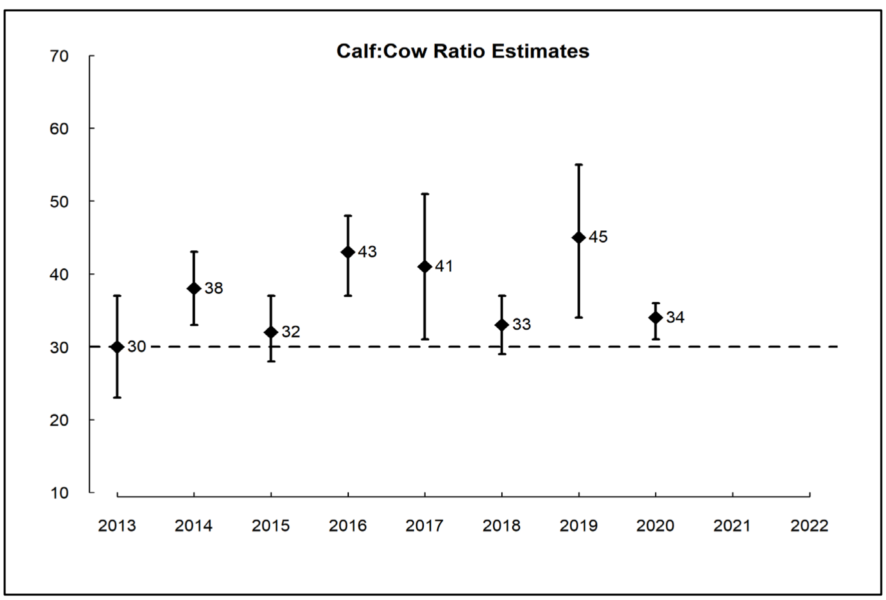

Figure 4. Estimates and associated 95% confidence intervals of post-hunt calf:cow ratios in the Willapa Hills elk herd area, spring 2013-2022. (Note - no surveys conducted in 2021 or 2022). The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth. 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, 2018, 2020 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. It 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, has been generally stable since 2012 (Figure 5), although antlerless elk harvest has declined slightly. No tribal harvests were reported for 2021, and tribal harvest has averaged less than 1% of the overall elk harvest for the past ten years. Nearly all harvest of antlered elk occurs during general seasons (Figure 6). An estimated 66% of the total antlerless harvest in 2021 was taken by non-tribal general season hunters, while the remaining 33% is attributed to permit hunters (Figure 7). Hunter effort has generally declined during that period, although it has risen during the last three years from a ten-year low in 2017 (Figure 8). Catch-per-unit-effort (CPUE), or the number of elk taken per 100 hunter days, has fluctuated between 2.05 and 2.52 elk harvested per 100 days effort since 2012 (Figure 9).

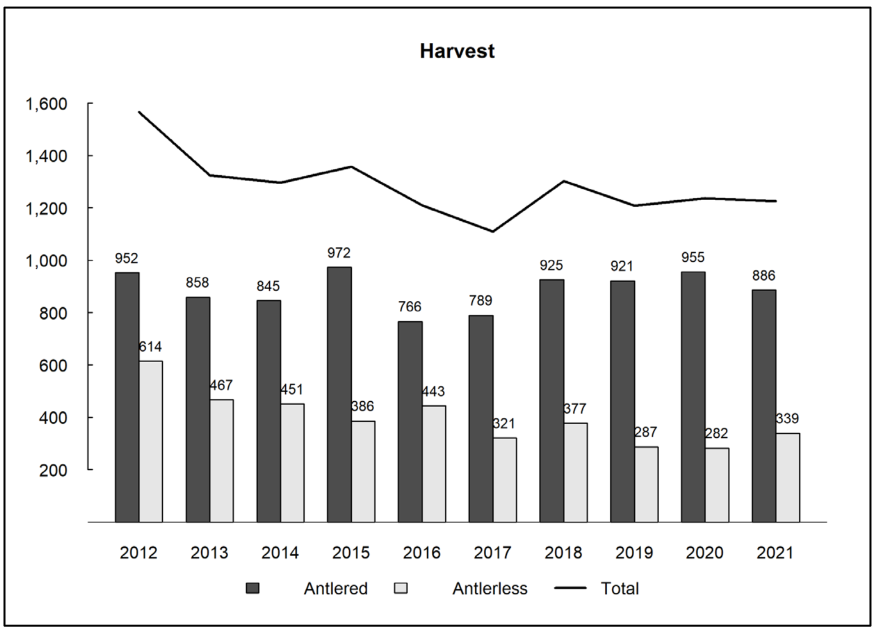

Figure 5. Estimated number of antlered and antlerless elk harvested in the Willapa Hills elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department and during established Tribal seasons, 2012-2021. Estimates of Tribal harvest were derived 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).

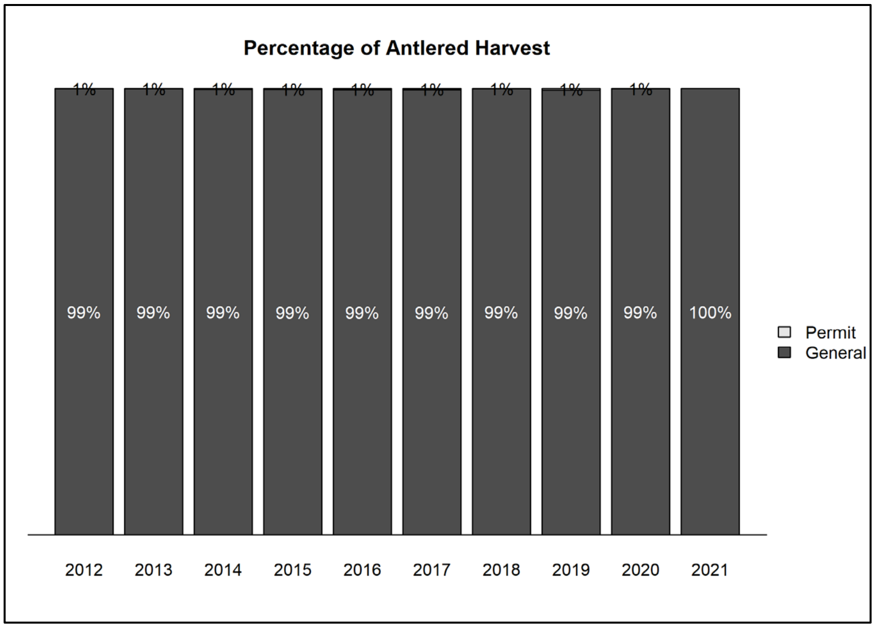

Figure 6. Estimated percentage of recreational antlered harvest in the Willapa Hills elk herd area that occurred during general and permit seasons, 2012-2021. Zero tribal harvest was reported and is not represented in the figure.

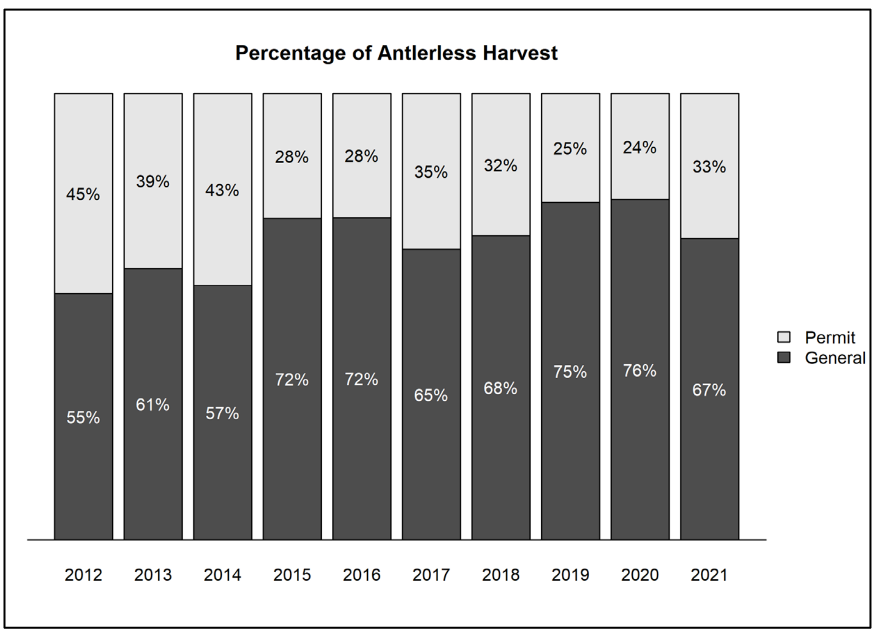

Figure 7. Estimated percentage of recreational antlerless harvest in the Willapa Hills elk herd area that occurred during general and permit seasons, 2012-2021. Zero tribal harvest was reported and is not represented in the figure.

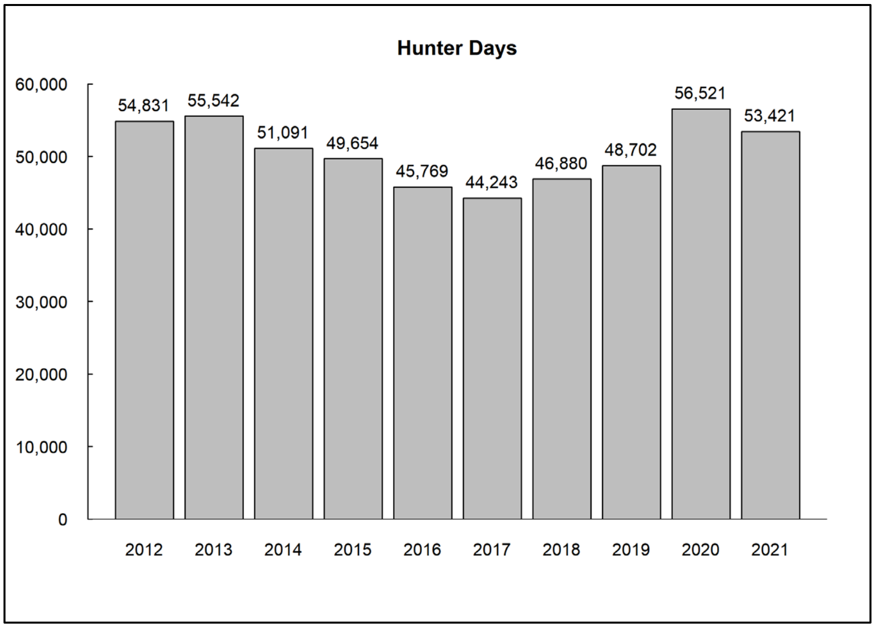

Figure 8. Estimated number hunter days spent pursuing elk in the Willapa Hills elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

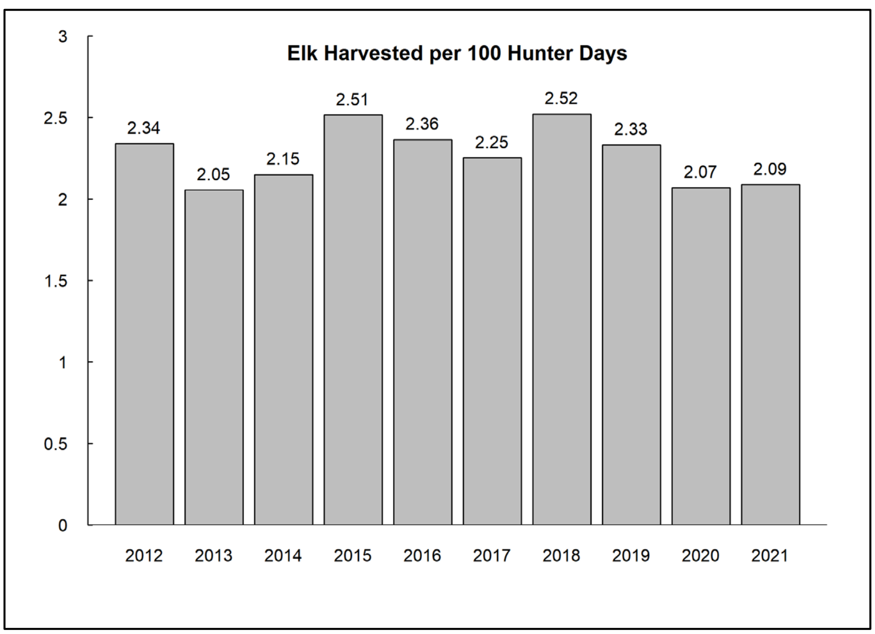

Figure 9. Estimated number of elk harvested given 100 days of effort in the Willapa Hills elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

Survival and Mortality

Common predators 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., 2021).

In June of 2021, the Willapa area encountered record-breaking heat (multiple days over 100° degrees Fahrenheit), potentially impacting adult elk and calf survival. The effect of this extreme heat event on the Willapa Elk herd is unknown. However, severe drought conditions that persist through summer and fall can potentially reduce the availability of high-quality forages that elk rely on to accrue adequate fat stores for winter. However, severe winter conditions rarely occur that affect the overwinter survival of elk in the Willapa Hills elk herd area.

The greatest source of mortality for bulls in the Willapa Hills elk herd is likely recreational harvest. There have yet to be comprehensive studies to estimate elk survival 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 represent the entire Willapa Hills elk herd.

No studies have occurred in the Willapa Hills elk herd area with the specific goal of estimating the 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 timber, and stream buffers lined with second-growth forest. This mosaic changes yearly due to ongoing timber-cutting operations. Forest management practices on private, industrial, and state forestlands have 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. As a result, 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. Logging, especially on private timberlands, county land, and state DNR lands, has increased foraging habitats within many 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 responding to elk conflicts generally increases hunting activity at the focal damage zones. These damage zones can cover an entire GMU or 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 infrastructures such as fences or irrigation systems.

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 2021-22, Wildlife Conflict Specialists managed at least 39 active DPCAs and worked with many additional landowners without a DPCA. A minimum of 90 elk permits were issued directly to landowners with a DPCA, resulting in 34 animals being harvested (Table 1).

In addition to using DPCAs and issuing elk permits to landowners, general season regulations may be liberalized to address elk conflicts within an area. Furthermore, 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. Few elk were harvested within the Willapa Hills elk herd area by the entire pool of permittees. Many of the elk harvested under these special permits are unavailable to the general licensed hunter due to the mosaic of land ownership and safety concerns about removing animals from areas near human habitation.

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, 2019-20.

Game Management Unit	DPCAs	Permits Issued	Elk Removed
506	9	25	15
530	2	4	3
658	10	21	4
660	2	7	2
663	1	5	1
672	3	3	0
673	5	12	5
681	3	8	3
684	4	5	1
Total	**39**	**90**	**34**

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 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 are 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 has researched to estimate the distribution and prevalence of TAHD better. In 2014, a citizen science effort incorporated volunteers to conduct road surveys to locate elk and identify the number of animals affected and the geographic distribution of the disease. To learn more about the Department's efforts to investigate TAHD, please visit the Department's hoof disease webpage: Elk Hoof Disease in WA State.

In 2021, a unique antlerless elk permit was issued to 15 hunters under the Master Hunter category to focus efforts on hoof-diseased animals in the Willapa Hills. Those permittees were allowed to harvest a second antlerless elk if they first harvested a hoof-diseased animal (verified by WDFW staff). This pilot program will continue in 2022.

Private Land Access

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

Management Conclusions

Harvest data indicate that the Willapa Hills elk herd was relatively stable during 2012-2022. Survey data from years previous to 2022 indicated 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.

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Yakima Elk Herd

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Introduction

The Yakima elk herd area is in central Washington and consists of 11 GMUs: 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 subherd 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.

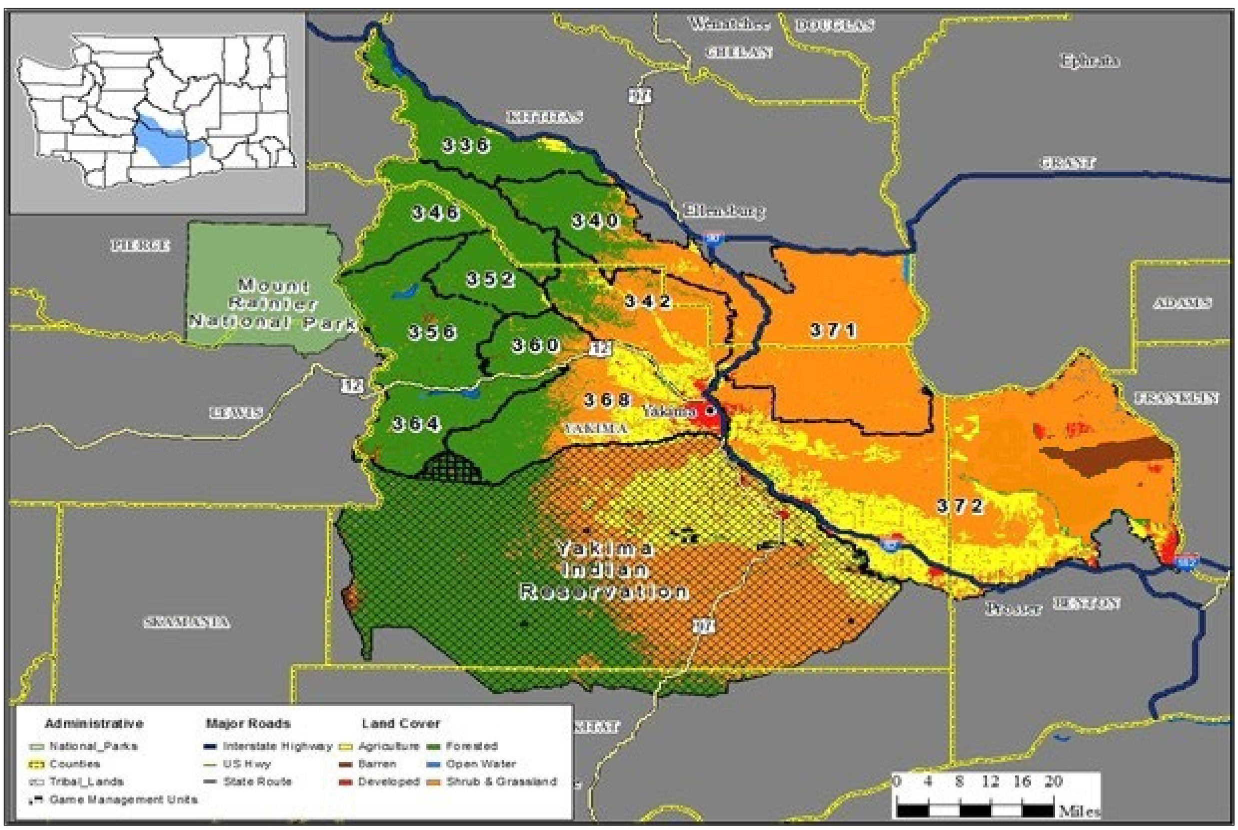

Figure 1. Dominant land use cover types within the 11 game management units that comprise the Yakima elk herd area.

Management Guidelines and Objectives

The Department's current management objective is for a post-winter population of approximately 9,000-10,000 elk in the core Yakima elk herd area (GMU's 336-368), <350 elk in the Rattlesnake Hills subherd area, and minimal populations of elk on the Yakima Training Center(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 feeding sites with estimates of elk abundance derived from areas adjacent to feeding sites. Biologists 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 the effects of concealment 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, 2020, 2021). However, surveys on feed sites to estimate calf ratios still occur in those years. Calf ratios in 2021 were derived from a sample of 4,964 elk surveyed on the feed sites.

In February 2022, the Department estimated elk abundance within the core survey area to be 11,324 elk (Figure 2), which was above the management objective. The bull:cow ratio was 13 (Figure 3). The population estimate was surprising given previous years of harvest/recruitment indices not suggesting significant population growth. These inconsistencies have generated concern over the 2022 abundance estimate. The increase in bulls to objective was likely due to fire closures during hunting season, which increased spike recruitment.

The Department collaborates with the U.S. Fish and Wildlife Service (USFWS) to estimate elk abundance in the Rattlesnake Hills subherd area using the Idaho sightability correction model. The most recent survey was conducted in January 2020. Elk abundance was estimated to be 1,646 elk, which far exceeds the management objective of 350 elk (Figure 5). No survey was scheduled for 2022. Bull:cow and calf:cow ratio estimates for the subherd are shown in Figures 6 and 7.

The northern 2/3 of the Yakima Training Center was surveyed in both March and July 2021. The March survey estimated 852 elk with 25 bulls and 20 calves per 100 cows. The calf ratio is questionable due to large groups that couldn’t be classified accurately. The July survey estimated 650 elk with 50 bulls and 33 calves per 100 cows.

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. Archers previously had general season opportunities to harvest antlerless elk, whereas modern and muzzleloader hunters were restricted to permit only. Master Hunters can harvest antlerless elk below the elk fence in Elk Area 3912 and from GMU 371.

Harvest declined by 60% between 2015-2017 and has remained at low levels since (Figure 8). Harvest does not include damage/kill permits or corrections for any permit non-report. It does include GMU 371, which has no direct connection to the surveyed population. 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.

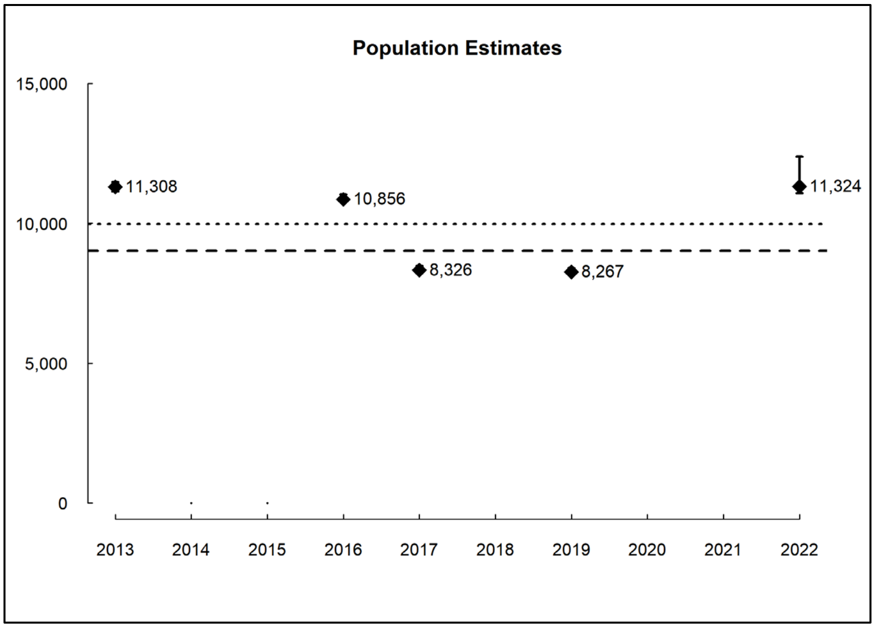

Figure 2. Sightability corrected estimates of total elk abundance with associated 90% confidence intervals in the Yakima elk herd area, spring 2013-2022. The dashed lines represent management objectives for total elk abundance (9,025-9,975 elk).

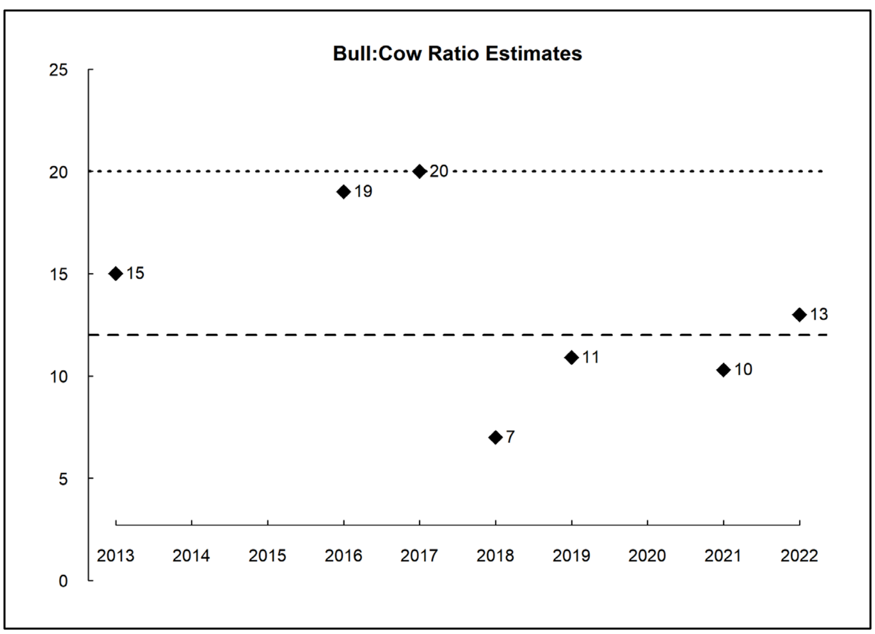

Figure 3. Estimates of post-hunt bull:cow ratios in the Yakima elk herd area, spring 2013-2022. The dashed lines represent the objective range of 12-20 bulls:100 cows. Estimates in 2018 and 2021 are based on ground sampling and are not thought to accurately reflect the true population ratios due to low observability of bulls from the ground.

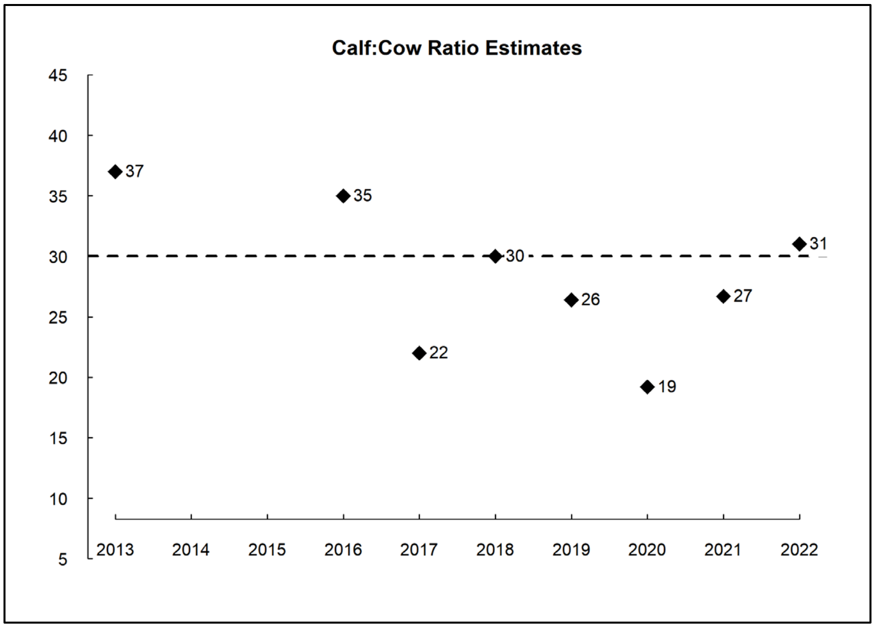

Figure 4. Estimates of post-hunt calf:cow ratios in the Yakima elk herd area, spring 2013-2022. The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth.

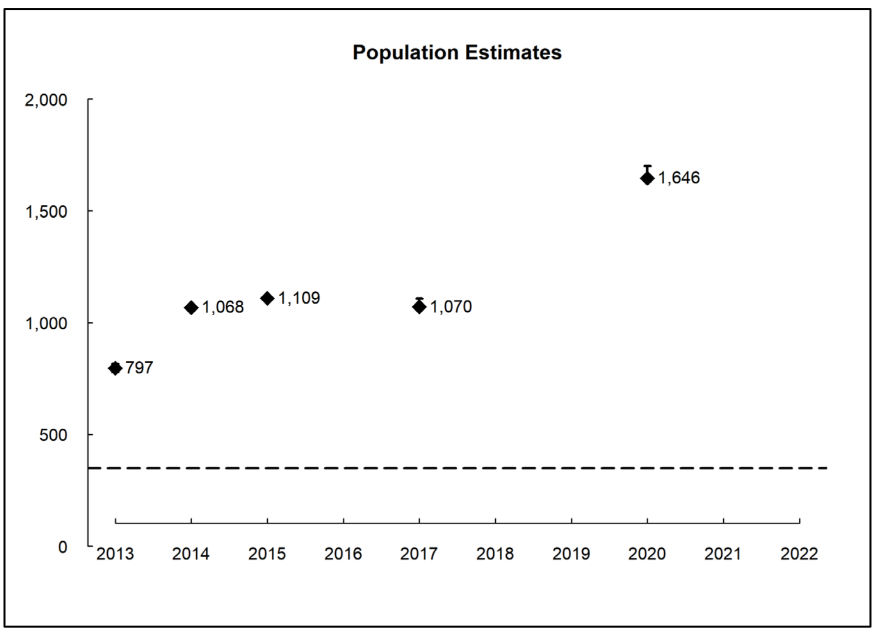

Figure 5. Sightability corrected estimates of total elk abundance with associated 95% confidence intervals in the Rattlesnake Hills subherd area, spring 2013-2022. The dashed line represents the management objective of ≤350 elk.

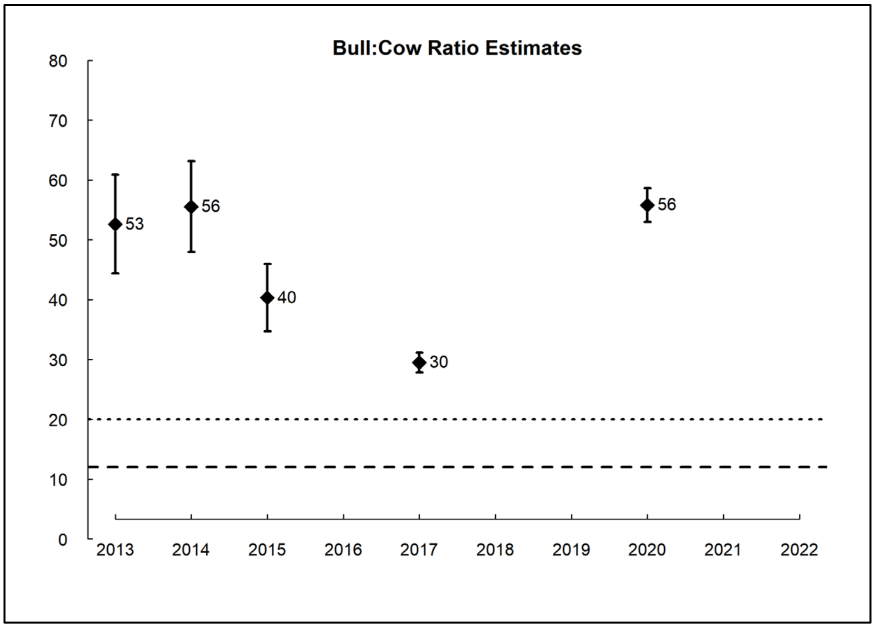

Figure 6. Estimates and associated 95% confidence intervals of post-hunt bull:cow ratios in the Rattlesnake Hills subherd area, spring 2013-2022. The dashed lines represent the objective range of 12-20 bulls:100 cows.

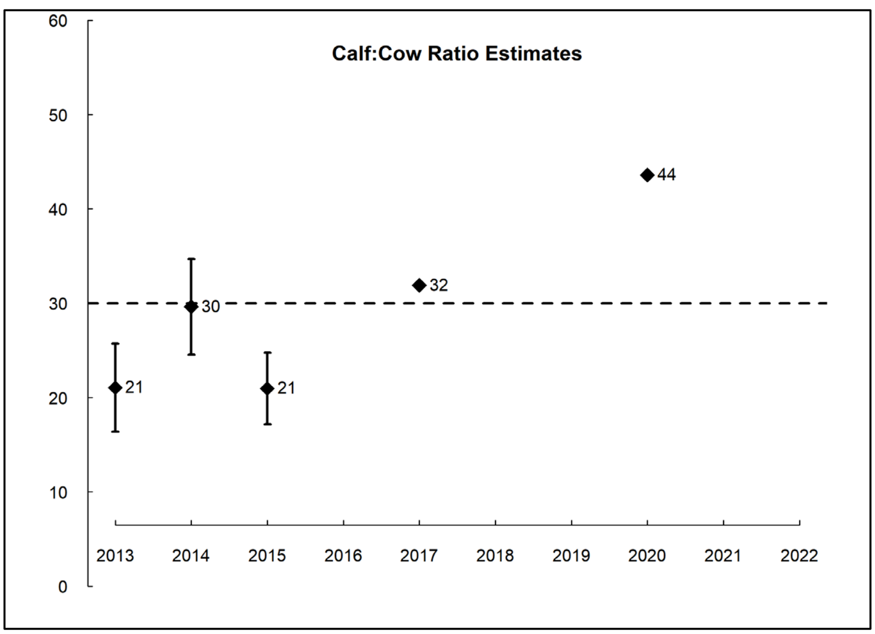

Figure 7. Estimates and associated 95% confidence intervals of post-hunt calf:cow ratios in the Rattlesnake Hills subherd area, spring 2013-2022. The dashed line represents a calf:cow ratio of 30 calves:100 cows that should promote herd stability or growth.

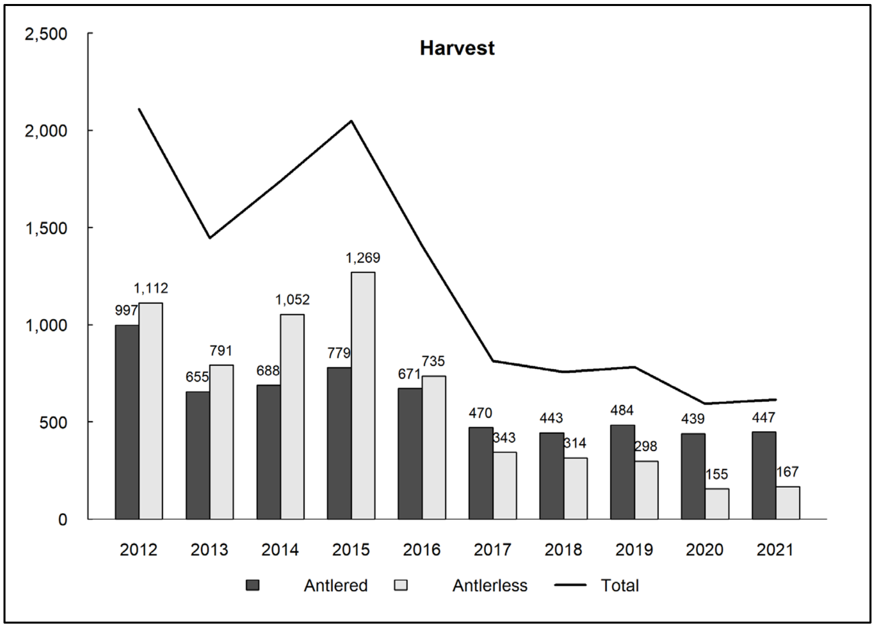

Figure 8. Estimated number of antlered and antlerless elk harvested in the Yakima elk herd area during recreational hunting seasons (general and permit opportunities combined) established by the Department, 2012-2021. Estimates do not include elk harvested in association with damage permits (see Human-Wildlife Interaction below). Estimates also do not include harvest that occurred during established Tribal seasons because those data are currently not available.

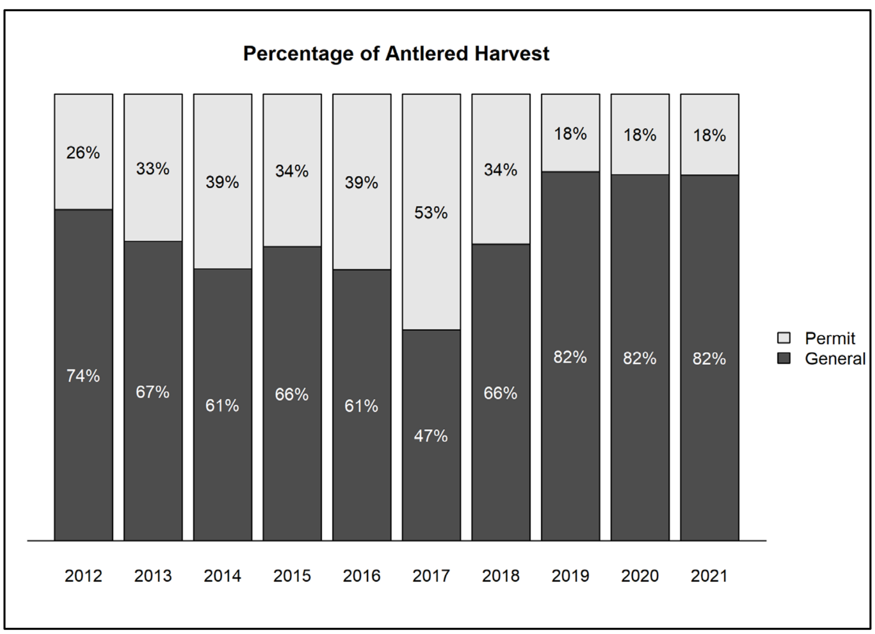

Figure 9. Estimated percentage of recreational antlered harvest in the Yakima elk herd area that occurred during general and permit seasons, 2012-2021.

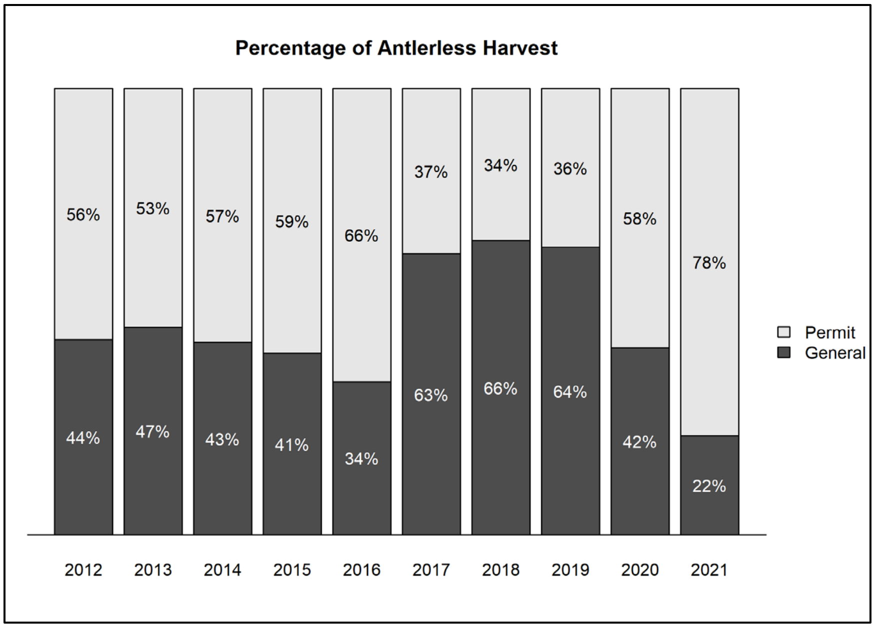

Figure 10. Estimated percentage of recreational antlerless harvest in the Yakima elk herd area that occurred during general and permit seasons, 2012-2021.

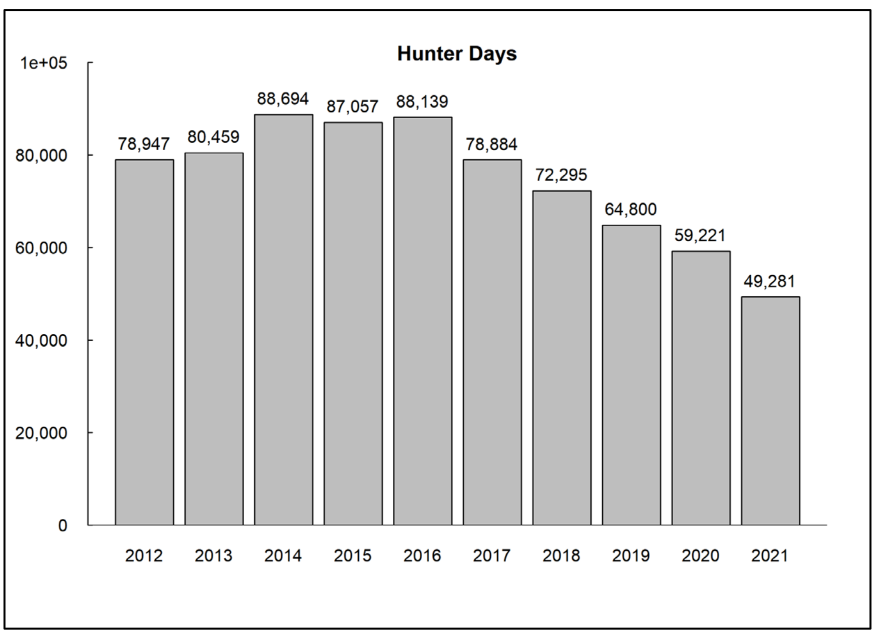

Figure 11. Estimated number of days hunters spent pursuing elk in the Yakima elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

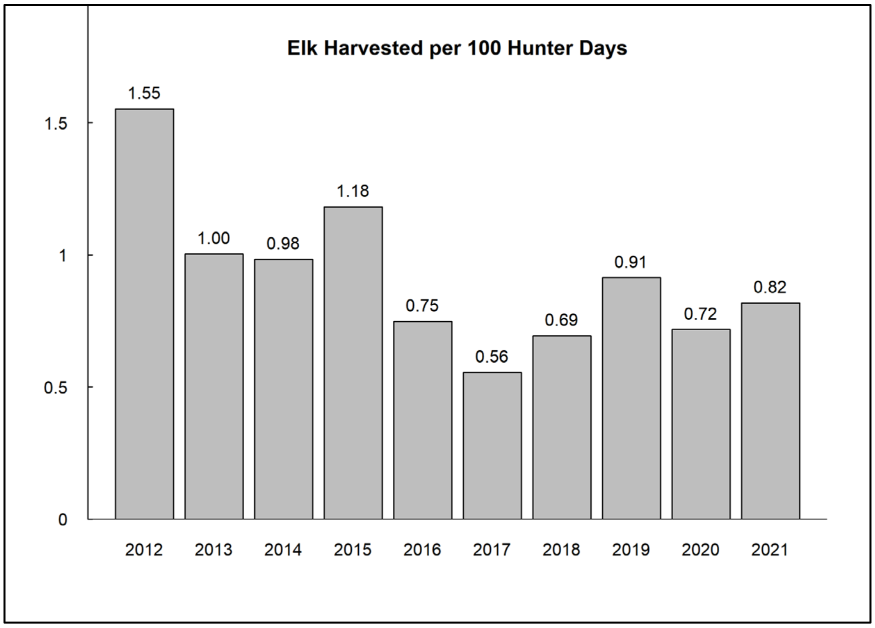

Figure 12. Estimated number of elk harvested for every 100 hunter days spent pursuing elk in the Yakima elk herd area during recreational seasons that provided general over-the-counter opportunities, 2012-2021.

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., 2021).

Substantial antlerless hunting opportunities occurred from 2012-2016 in an attempt to reduce the population. However, after the 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. The herd's lack of winter die-off is partially due to up to 70% of the herd being fed during more 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 declined due to higher-than-average winter mortality for adult cows and low calf recruitment. Antlerless harvest has since been reduced, but overall calf recruitment has remained 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 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.

In GMU 372, occupied by the Rattlesnake Hills subherd, crop damage is a constant concern amongst producers near the Arid Lands Ecology Reserve, which provides refuge for most of the subherd year-round. The elk also damage sensitive shrub-steppe and natural spring sites in the arid landscape, and traffic collisions are becoming a concern. There are no elk feeding sites near the Rattlesnake Hills. From April 2021 thru March 2022, about 200 damage prevention and 15 kill permits were issued to landowners in the Rattlesnake Hills subherd area, resulting in a minimum harvest of 62 elk. In addition to these permits, non-lethal deterrents and public hunting have reduced conflict over the past decade, despite an increasing elk population.

Management Concerns

The Yakima elk herd had been at or above objective since 2010-2015 and had been very productive. Surplus elk allowed for significant recreational opportunities, including antlerless harvest. Recreational harvest, drought, and severe winter weather in 2015-2016 reduced herd size and hunting opportunities. The herd has historically rebounded quickly after poor recruitment years. Harvest and recruitment indices and the 2022 population estimate provide conflicting information on population growth; therefore, the 2022 antlerless permit levels are intended to maintain population stability. Subsequent surveys will provide a better understanding of population trends enabling more informed management.

There are often questions about the winter-feeding program and ways to get elk to move from feed sites to their 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 initially obtained lands 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 the 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 the need to control elk distribution in winter and reduce motivation to move lower into private property areas; elk are not fed to prevent starvation.

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

The Rattlesnake Hills subherd population remains well above the management objective. The Department's ability to manage this population is limited because most elk seek refuge on large federal properties closed to hunting and public access. However, discussions with Federal land managers in 2020-2021 failed to identify workable options for elk management despite concerns related to traffic safety, ecological damage, and crop depredations.

The GMU 371 elk population is increasing and causing concern for local farmers. Some high-value orchards have been fenced, but elk skirt the end into hay fields. More fencing is needed. Consistent harvest in GMU 371 can be difficult. The area is a military installation open to hunting, but training dictates what areas are open. There is a large impact area that is off-limits to all access. Elk have learned that bombs are less of a threat than people on foot/driving. When hunting pressure is applied, the elk retreat to the impact area. The impact area burns frequently and provides good forage when the cheatgrass is green. During the March 2021 survey, only 25 elk (all bulls) were observed outside the impact area.

The damage to crops is mostly during the summer—some elk cross I-90 from the Colockum and winter on YTC. The current seasons are long, with abundant antlerless opportunities concentrated early in the fall. WDFW's 2021 harvest estimate (likely low) was 33 antlerless and 29 bulls. A balance is needed between providing the opportunity for all user groups and trying to reduce the herd.

Management Conclusions

The increase in elk in the core Yakima herd from the 2022 survey may not be accurate. The goal of 12–20 bulls:100 cows in the post-hunt population was in objective in 2022 for the first time since 2017. There are likely more bulls outside of the feed sites/survey area, but the recent declines in bull recruitment is not keeping up with total bull mortality. Because of this branched bull opportunity has been reduced. The short-term increase in spike recruitment due to fire closures helped the ratio, but adult bulls are still lacking. The Rattlesnake Hills subherd 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 subherd. The increase in elk numbers and GMU 371 is a concern. While hunting is allowed in GMU 371, there is no allowed entry into the impact area, which limits the ability to manage elk on YTC.

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Mountain Goat

Mountain Goat Status and Trend Report: Region 2

Chelan County

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JOHNNA EILERS, Assistant District Wildlife Biologist

Management Guidelines and Objectives

The statewide management goals for mountain goats are to perpetuate productive populations and ensure long-term genetic connectivity, to provide opportunities for a wide range of non-consumptive uses, and to enhance populations to provide sustained recreational hunting opportunities.

WDFW manages two mountain goat populations within the Lake Chelan Basin, the South Shore and North Shore herds. These herds correspond with the designated Mountain Goat Hunt Areas South Lake Chelan and Chelan North, respectively. Limited harvest of the Lake Chelan mountain goat populations began in 2001 for the North Shore herd and 2012 for the South Shore herd (WDFW, 2014). Currently, WDFW offers one special permit for the North Shore herd and one for the South Shore herd.

Population Surveys

Mountain goat populations in Chelan County remain below the historical levels of the 1960s. Observational data suggest that the number of goats in populations not open to hunting may increase from the historically low numbers of 30 years ago. For the Lake Chelan populations, which the Chelan Public Utility District (PUD) has monitored since 1982, the number of goats observed each winter has fluctuated over time. Still, counts in recent years have declined significantly (Figures 1 & 2). The past 13 years of boat surveys have yielded counts well below 100 animals on the North Shore (Range: 17-81). On the South Shore, the number of goats observed indicated the population was sufficient to allow for harvest from 2009 to 2013 (Range: 94-128). However, counts have been substantially lower since then, with a maximum of 17 to 51 goats observed each winter from 2013-2014 (Table 1).

From 2006-2019, Chelan PUD conducted 12 winter wildlife surveys annually from a boat platform on Lake Chelan to inventory and monitored big game and other wildlife (Pope & Cordell, 2020). Surveys typically occur from November to February and are the only annually collected, long-term dataset for Chelan County mountain goats. The total number of known goats in the South Shore and North Shore herds is the comparison of results from all surveys completed during each winter. During the winter of 2020-2021, PUD personnel performed only two boat surveys. High counts for both herds occurred during December, with 17 goats observed on the North Shore and 51 on the South Shore. In the winter of 2021-2022, PUD personnel did not perform any boat counts, and WDFW biologists conducted one boat survey of the North Shore, during which only 22 goats were observed.

Due to available terrain, rugged topography, and tree cover, mountain goats can be extremely difficult to survey from a boat. Year-to-year counts vary widely due to snow accumulation and weather conditions along the lake. During heavy snow years, goats generally concentrate in higher densities along the lake to winter, providing a better opportunity to observe them than in years of lighter snowfall. Due to the high potential for biased counts resulting from boat surveys, the 2018-2022 Lake Chelan Wildlife Habitat Plan includes a provision allocating funds that allows WDFW personnel to plan and conduct annual species-specific aerial surveys to estimate the abundance of mountain goats, bighorn sheep, and mule deer in the Lake Chelan Basin (Chelan PUD, 2018).

Low snowfalls in recent years have created challenging conditions in which to survey. With adequate snowfall, goats move down to lower elevations where the likelihood of observation increases. Compared to ongoing boat-based survey methods, in February 2015, WDFW biologists conducted a helicopter-based aerial survey using sightability correction to estimate goat numbers in a subsection of habitat on the North Shore of Lake Chelan. Although this survey was not exhaustive, results showed that large numbers of goats occupying the 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). The maximum count from boat-based surveys conducted the next day totaled 15 goats (Pope & Cordell-Stein, 2015).

Table 1. Compiled maximum counts from ground and boat-based surveys in Chelan County 2009-2022.

Winter	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				
2019-20	20	36	17	41				
2020-21	17	55	51	59				
2021-22	22							

*** Data from Chelan PUD Winter Boat Surveys. **Increase due to increase in volunteer survey effort.**

Adult:Kid ratios calculated from total positively identified animals only.

A February 20, 2020, aerial survey of the South Shore recorded a raw count of 20 goats. A simultaneous boating survey along the South Shore of Lake Chelan yielded no mountain goat observations that day. These results suggested that Lake Chelan mountain goat populations were larger than the boat-based surveys indicated.

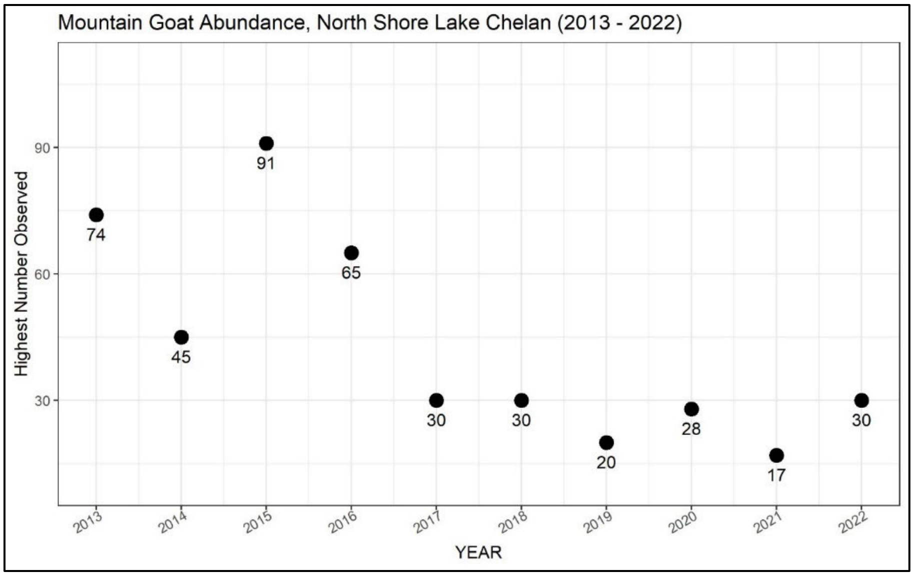

Figure 1. Number of mountain goats observed on the North Shore of Lake Chelan via boat or aerial survey for each of the past 10 years. Numbers presented in 2015 and 2022 are sightability-corrected estimates from aerial surveys.

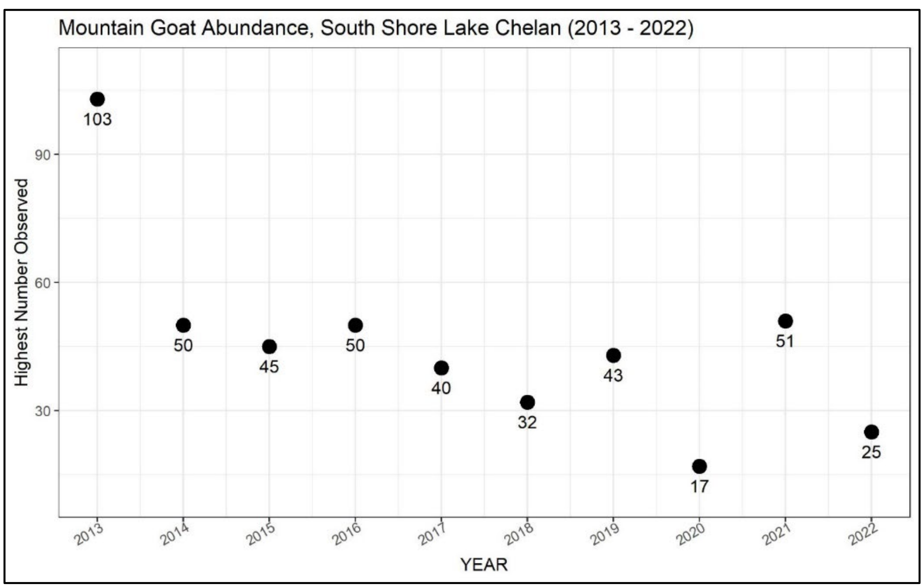

Figure 2. Number of mountain goats observed on the South Shore of Lake Chelan via boat or aerial survey for each of the past 10 years. The number presented for 2022 is a sightability-corrected estimate from an aerial survey.

However, aerial surveys performed since 2015 have returned far fewer observations of mountain goats than expected. WDFW conducted aerial mountain goat population surveys in the summer of 2019 and the winter of 2019-2020, both on the South Shore of Lake Chelan. Although survey coverage was extensive, only approximately 20 goats were observed during each effort.

One more attempt was made to comprehensively survey delineated summer range for both the North and South Shore herds in June 2021 and resulted in even fewer goat detections than the previous year's efforts. Surveyors observed only a single goat on the North Shore and ten goats on the South Shore over three days of flights. The most recent aerial survey, performed in February 2022, saw only 23 goats on the North Shore and 20 on the South Shore.

In other areas of Chelan County, winter mountain goat counts conducted between 2010 and 2015 along driven survey routes returned higher numbers over time, which suggests these populations were increasing over this time period. Additionally, volunteer-led survey efforts conducted along hiking routes in 2008-2015 sought to determine the presence of goats in portions of the Alpine Lakes Wilderness for which no data had previously been available. Surveys averaged a high count of 65 mountain goats per year, which was comparable to previously compiled estimates of 50-75 animals in the Alpine Lakes Wilderness (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, WDFW biologists successfully conducted aerial surveys of mountain goats in the Alpine Lakes Wilderness area, including the Enchantments, Icicle Ridge, and the Wenatchee Mountains. Using a sightability-corrected survey, biologists estimated 71 goats with a 90% C.I. of 60-83. 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 for over 20 years. In 2001, two permits were authorized for Chelan North, and two male goats were harvested. Only one permit was issued each year from 2002-2008, with permits increasing to two in 2009. Hunter success has varied from year to year but has been high, with hunters in the Chelan North unit enjoying an 85% success rate over the past 13 years and a 70% success rate for the South Lake Chelan unit over the ten seasons since its opening (Tables 2A-2B). Rugged terrain and remote wilderness with restricted access can limit hunter success and make finding adult males difficult. Over the past 13 years in Chelan North, 32% of harvested animals have been nannies. In the ten years the South Lake Chelan unit has been open to hunting, zero females and seven male goats have been harvested.

In 2021, special permit levels for both Lake Chelan herds remained the same (two permits for the North Shore and one for the South Shore), but both the North and South Shore herds were removed from the list of possible locations for the raffle hunt. Dropping these two herds as raffle hunt options was in response to the lack of recent data indicating stable or increasing goat populations on either side of Lake Chelan. In 2022, both herds remain off the list of possible raffle hunt locations, and North Shore permits were reduced from two to one. This further reduction was due to yet another low population count being obtained for each shore during the February 2022 aerial surveys. However, as WDFW and PUD biologists have continued to observe very few goats during survey efforts for several years now, no permits will be offered in either goat hunt unit in 2023.

WDFW intends to perform an aerial capture effort for goats in the Lake Chelan Basin in January 2023 to collar ten goats in each herd. This capture is the next step in WDFW's ongoing efforts to estimate the population of both the North Shore and South Shore herds. Until these populations are shown to meet the minimum threshold to sustain harvest, goat hunting in the Lake Chelan Basin will remain closed indefinitely following the 2022 season.

Table 2A. Summary of Mountain Goat Harvest for North Lake Chelan, 2009-2021.

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
2019*	2	2	2	2	0	100	11
2020	2	2	2	2	0	100	12
2021	2	1	1	1	0	100	3
Total	**26**	**22**	**19**	**13**	**6**	**85%**	**124**

***For 2012, 2013, and 2019, additional harvest of one mountain goat from raffle/auction hunts not included.**

Table 2B. Summary of Mountain Goat Harvest for South Lake Chelan, 2012-2021

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
2019*	1	1	1	1	0	100	10
2020	1	1	1	1	0	100	25
2021	1	1	1	1	0	100	8
Total	**10**	**9**	**7**	**7**	**0**	**70%****	**95**

***Additional harvest of 2 mountain goats from raffle/auction hunts in 2018 and 1 mountain goat in 2019 not included. **Success calculation does not include 2012, in which a permit was issued, but no hunt took place.**

Mountain goat populations within the East-Central Cascades (Chiwawa, East Stevens Pass, North Wenatchee Mountains, and Stehekin) are not surveyed intensively enough to confidently estimate 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

Since the implementation of annual winter boat-based surveys began in 1982 to the winter of 2020-2021, the kid-to-adult ratios for both herds observed during these counts have been adequate for population growth in most years. From the winter of 2015-2016 to the winter of 2019-2020, boat-based survey observations on the North Shore herd averaged approximately 33 goats (range: 20-65) and 29.8 kids:100 adults (range: 20-38) (Pope & Cordell, 2020). For the South Shore herd, the average number of goats observed over that same period was 36.4 (Range: 17-50), with 20.2 kids:100 adults (Range: 6-41).

A relatively large proportion of goats observed during the 2020-2021 boat-based surveys were kids. Seventeen mountain goats were observed on the North Shore of Lake Chelan with a 55 kid:100 adult ratio; on the South Shore, 51 goats with a ratio of 59 kids:100 adults were observed. These numbers represent the highest observed kid:adult ratios for both herds in over a decade. However, an important caveat here is that the small number of mountain goats observed during the previous several years' surveys may not represent the entire herd. As such, the ability to quantify herd composition is limited, and kid-to-adult ratios presented here are indeterminate. For the same reason, kid-to-adult ratios obtained from the February 2022 aerial surveys are also suspect at 29:100 for the North Shore herd and 12:100 for the South Shore herd.

Habitat

During the last 50 years, fire suppression has decreased the 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 conditions caused primarily by wildfires. Fires initially reduce mountain goat habitat but increased forage post-fire benefits goats. Over the last fifteen years, several major fires in the Lake Chelan Basin (both shores) and North Wenatchee Mountains (Icicle and Tumwater Canyons) have burned substantial mountain goat habitat. The subsequent increase in early seral-stage vegetation and forage may have contributed to the increase in mountain goat counts during the same time, 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 recovering from the 2007 Domke Lake fire, the 2004 Deep Harbor fire, and the 2014 Duncan fire. Overall, little is known about the long-term effects of fire on mountain goat populations. Biologists do not know if the extensive fire activity in the Lake Chelan basin has impacted herd numbers there. If the January 2023 capture and collaring effort proves successful, biologists can glean information on how the Lake Chelan goats use these previously burned areas.

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. In 2004, three adult nannies were fitted with GPS collars 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 mi2 areas near their capture locations.

Insight was also gained into gene flow and interactions between populations. This was highlighted by two nannies collared on Gamma Ridge on Glacier Peak that each traveled 10-12 miles east to the south shore of Lake Chelan. Permit numbers for the South Lake Chelan unit consider the potential harvest of goats from Region 4. Three 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. Upcoming collaring efforts have the potential to greatly enhance our limited knowledge of the Lake Chelan goats' movements and possible interactions with other populations. Ideally, having collars out in both herds will help biologists get a better idea of population size and trends by enabling the use of the mark-recapture methodology.

Management Conclusions

Most mountain goat populations in Chelan County are below historical levels and are not hunted. Population trends in District 7 outside the Lake Chelan area can only be effectively monitored with additional survey resources. Based on Chelan PUD and WDFW survey data, annual counts of the Lake Chelan North Shore and South Shore herds have been declining in recent years, and there is every indication that both herds are too small to allow for the continuation of harvest. As such, 2022 will be the last season in which hunting is permitted in either Lake Chelan goat hunt unit for the foreseeable future. Beginning in 2023, South Lake Chelan and Chelan North will be closed to hunting, and permits will not be reinstated in either unit until the herd is definitively observed to meet the minimum threshold for harvest.

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, better to understand trends in mountain goat populations and their distribution. Given the large fire events in the past fifteen 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 continue to be gaps in biologists' 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 populations and improved abundance estimates should be prioritized.

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Mountain Goat Status and Trend Report: Region 2

Methow

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JEFF HEINLEN, Wildlife Biologist

Management Guidelines and Objectives

The Methow unit (Goat Unit 2-2) is currently being managed for population growth and increased distribution. WDFW encourages the public to take advantage of watchable wildlife opportunities at the salt lick along Hart's Pass Road and on Grandview Mountain northwest of Palmer Lake.

Population Surveys

As resources allow, the Department conducts annual surveys to determine minimum population size and herd productivity. Units with huntable populations are prioritized for limited aerial survey dollars. These data are used to generate hunting permit allocations in accordance with statewide management guidelines. The last survey in the Methow Unit occurred in 2016, but despite good conditions and timing, only 38 goats were observed (Table 1).

Table 1. Population composition counts from the Methow Unit.

Year	Kids	Yearling	Adults	Minimum Population	Kids:100 Adults
2011	--	--	--	--	--
2012	--	--	--	--	--
2013	6	5	15	26	*40
2014	--	--	--	--	--
2015	--	--	--	--	--
2016	10	2	26	38	*38
2017	--	--	--	--	--
2018	--	--	--	--	--
2019	--	--	--	--	--
2020	--	--	--	--	--
2021	--	--	--	--	--

Hunting Seasons and Recreational Harvest

Statewide mountain goat management guidelines recommend considering harvest permits only for management units with a population size of at least 100 goats. The two most recent surveys in the Methow Unit suggest the population is well below that threshold. As a result, no harvest permits have been issued for the last several seasons.

Survival and Mortality

Limited survey data suggests the population in the Methow Unit has declined over the last 15 years, although the kid-to-adult ratio of the animals seen remains favorable. Incidental observations outside of the hunting unit verify that small numbers of goats are persisting in pockets scattered throughout adjacent suitable habitats in the Okanogan District, so the potential for immigration exists. Due to a lack of resources, little survey work has been done in these areas. As a result, population size and trend are unknown for these animals.

Additionally, 49 mountain goats removed from the Olympic Mountains were translocated to the Methow Unit over three summers beginning in 2018. These releases sought to augment the existing population, boost genetic diversity, and improve connectivity with goat bands outside the unit.

Habitat

Goat habitat is almost entirely within secured areas, and habitat availability remains stable. Habitat quality varies noticeably throughout the 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. Fire exclusion may have reduced the quantity or quality of summer forage resources for goats in some alpine terrain; however, goats in areas that have burned in the last 20 years appear to be doing well. A wildfire burned a significant part of the southern portion of the unit during the summer of 2021 and is expected to improve forage quantity and quality for several years to come.

Management Conclusions

Management objectives should continue to focus on population growth and distribution expansion. Resources are needed to allow for a consistent and methodical annual survey to determine population size and trends better. 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 between the two herd segments, although recent translocations may help alleviate this. In addition, the 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 reflect goat distribution better will be explored.

Mountain Goat Status and Trend Report: Region 3

Blazed Ridge, Bumping River, Naches Pass

JEFFREY A. BERNATOWICZ, Wildlife Biologist

Management Guidelines and Objectives

The statewide goals for mountain goats are:

1. Preserve, protect, perpetuate, and manage mountain goats and 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, they must support 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. No surveys were conducted in 2021 due to closures around wildfires.

Hunting Seasons and Recreational Harvest

Mountain goat seasons are open only to hunters drawing a special permit, winning a raffle, or auction. In 2021, there was one permit issued in Naches/Corral Pass where one billy was harvested, and the auction hunter took a billy from Blazed Ridge. Bumping was closed to access due to a wildfire. (Tables 1-3).

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 historical levels due to over-harvest. WDFW harvest management calls for the harvest 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. Populations appeared to be increasing from 2010-2015, but fewer goats have been seen in the last few surveys. 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 historical levels due to over-harvest. WDFW harvest management calls for the harvest 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. Populations appeared to be increasing 2010-2015, but fewer goats have been seen in the last few surveys. The trend for Kachess Ridge is unknown, as no surveys have been conducted there since 2005.

Habitat

Most goats in the Bumping and Naches Pass areas spend summers in wilderness areas where 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. In 2021, a large fire burned much of the mountain goat range in the Bumping unit. Recreational use could also be influencing the use of available habitat. There is no comprehensive documentation of the goats' winter range. Outside the wilderness areas, timber harvest and road density 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 are 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 the 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 appeared to be increasing since harvest has been restricted to 4%. The severe drought in 2015-2016 was followed by more severe winters, which impacted deer and elk, so goats were also affected. It is also possible goats are missed on surveys. Goats are often in groups, which can be in timber during the survey. The Blazed Ridge Unit is an example of how surveys can vary. In the past ten surveys, population estimates for Blazed Ridge have ranged between 26 and 104 goats. The differences among years are often much greater increases/decreases than would be expected biologically. Goats may either be missed on surveys or moved in/out of the survey area. Hunters in Naches Pass indicated goat numbers appeared lower, as sightings of billies were low, and the fire either caused a relocation of animals or decreased numbers.

The goal is to have hunters harvest billies instead of nannies. At least the first three years, the mandatory inspections had shown limited success. The recent splitting of units will likely worsen the issue in areas like Naches Pass; the billies tend to be more west of the Pacific Crest Trail, just outside the current unit. Forcing hunters into a smaller area with fewer choices will likely cause hunters to take nannies on the once-in-a-lifetime permit if billies can't be found.

Current unit boundaries may not correspond to biological populations. Gene flow likely 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 overharvesting, 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 six 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 only cover some 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. 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 population subdivision would 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 opportunities.

Statewide Mountain Goat 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.

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Table 1. Harvest and Surveys for Bumping River (Mountain goat Unit 3-7) 2010 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**
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
2019	2	2	3 (1)	No	Survey		
2020	2	1	1 (1)	25	64	89	39
2021	0	0	0				

* Includes auction/raffle [a] Includes unclassified/yearling

Table 2. Harvest and surveys for Naches/Corral Pass (Mountain goat Unit 3-6 and 4-38) 2010 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**
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
2019	2	2	1 (1)	No	Survey		
2020	2	2	2 (1)	38	66	107”	57
2021	1	1	1				

* Includes auction/raffle/tribal [a] Includes unclassified

Table 3. Harvest and surveys for Blazed Ridge (Mountain goat Unit 3-10) 2010 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**
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
2018	0	0	0	No	Survey		
2019	0	0	0	No	Survey		
2020	0	1*	1	5	21	26	24
2021	0	1*	1				

* Includes auction/raffle

Mountain Goat Status and Trend Report: Region 4

Mt. Baker and Boulder River North Areas

ROBERT WADDELL, Wildlife Biologist
KURT LICENCE, Wildlife Biologist

Management Guidelines and Objectives

The management objective for mountain goats in WDFW Region 4 is to maintain stable populations in all units for public viewing and harvest opportunities. The WDFW 2015–2021 Game Management Plan (2014) lists specific guidelines for managing harvest within sustainable limits. Guidelines restrict harvest to 4% or less of the estimated population (excluding kids), only allow harvest in goat populations meeting or exceeding 100 total animals, and limit nanny harvest to 30% of the total harvest. 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 three years. If guidelines are exceeded, harvest strategies may need to be revised to prevent population declines.

After being closed for many years, WDFW reopened the Mt. Baker area on a limited basis for mountain goat hunting in 2007. Subsequent surveys in this area suggested an increasing population (see previous Game Status and Trend reports), which permitted a gradual increase in hunting opportunities (Table 1).

Mountain goat surveys in 2012 within the Boulder River Wilderness Area also suggested greater numbers than in the early 2000s. The number of mountain goats in this area met the minimum requirements to establish a hunting season set in the 2015–2021 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 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 in both Boulder River and the Mt Baker area. In 2018, WDFW began translocating mountain goats from Olympic National Park to the North Cascades. Therefore, WDFW did not survey mountain goats at Boulder River (Figure 1) or Mt. Baker (Figure 2) in 2018 or 2020 because funds were allocated to the mountain goat translocation project. Due to the inconsistent classification of adults and yearlings in previous surveys, individual goats were classified as either adults or kids beginning in 2019.

Tribes, including the Stillaguamish, Tulalip, and Sauk-Suiattle Tribes, surveyed the Boulder River Unit in 2015, 2017, 2018, 2020, and 2022. The 2022 survey generated an estimate of 16 goats (90% CI = 12.1–20.4). Surveys conducted in 2020 (Sauk-Suiattle and Tulalip Tribes) and 2021 (WDFW) generated total estimates of 45 goats (90% CI = 37–53) and 17 goats (90% CI = 11–24; Figure 1), respectively. The 2022 survey represents the third year where biologists calculated an estimate of fewer than 100 goats.

The Upper Skagit, Lummi, and Swinomish Tribes surveyed the Mt. Baker area in 2022, generating a total estimate of 167 goats (90% CI = 153–181). WDFW surveyed the Mt. Baker area in 2021, generating a total estimate of 164 goats (90% CI = 149–179; Figure 2).

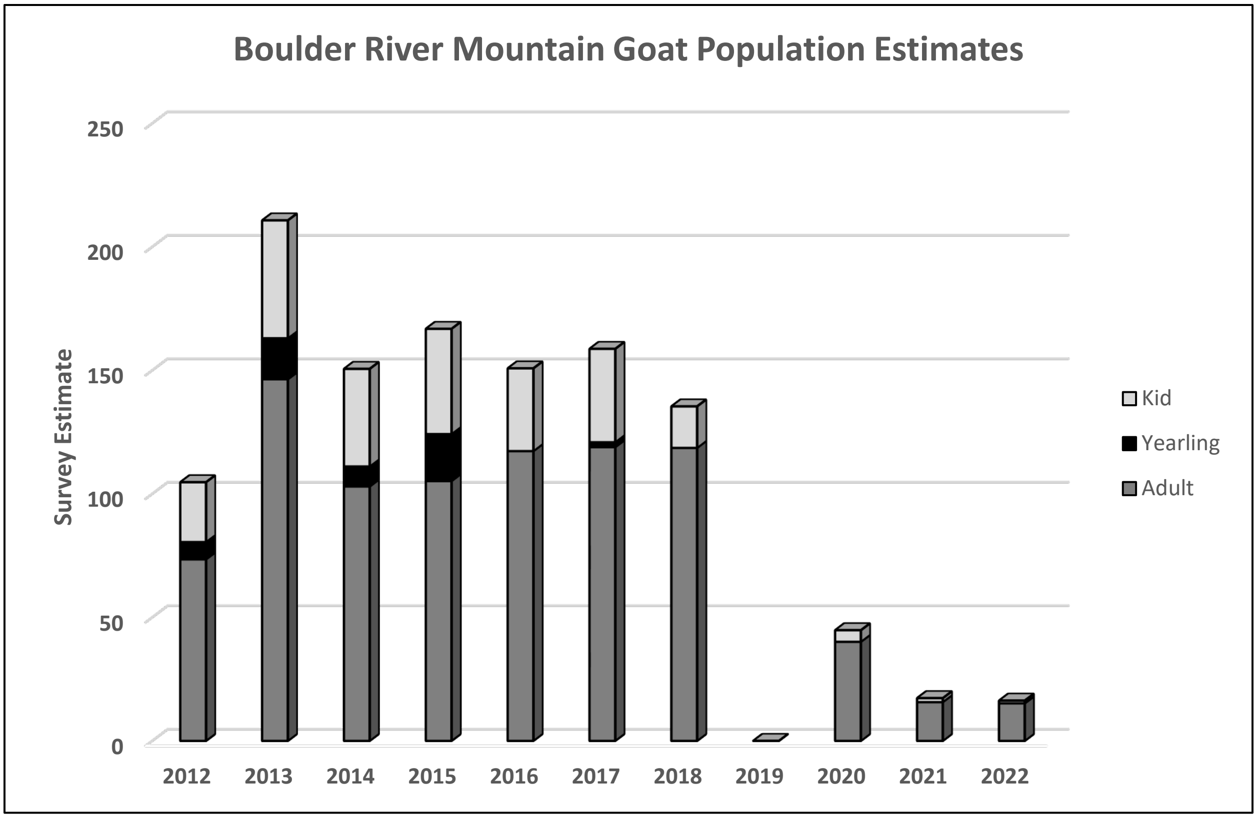

Figure 1. Results from mountain goat aerial surveys in the Boulder River North Hunt Unit from 2012–2022. No survey was conducted in 2019 due to mountain goat translocation work. Estimates are calculated based on numbers derived from the Three Fingers and Whitehorse survey blocks only.

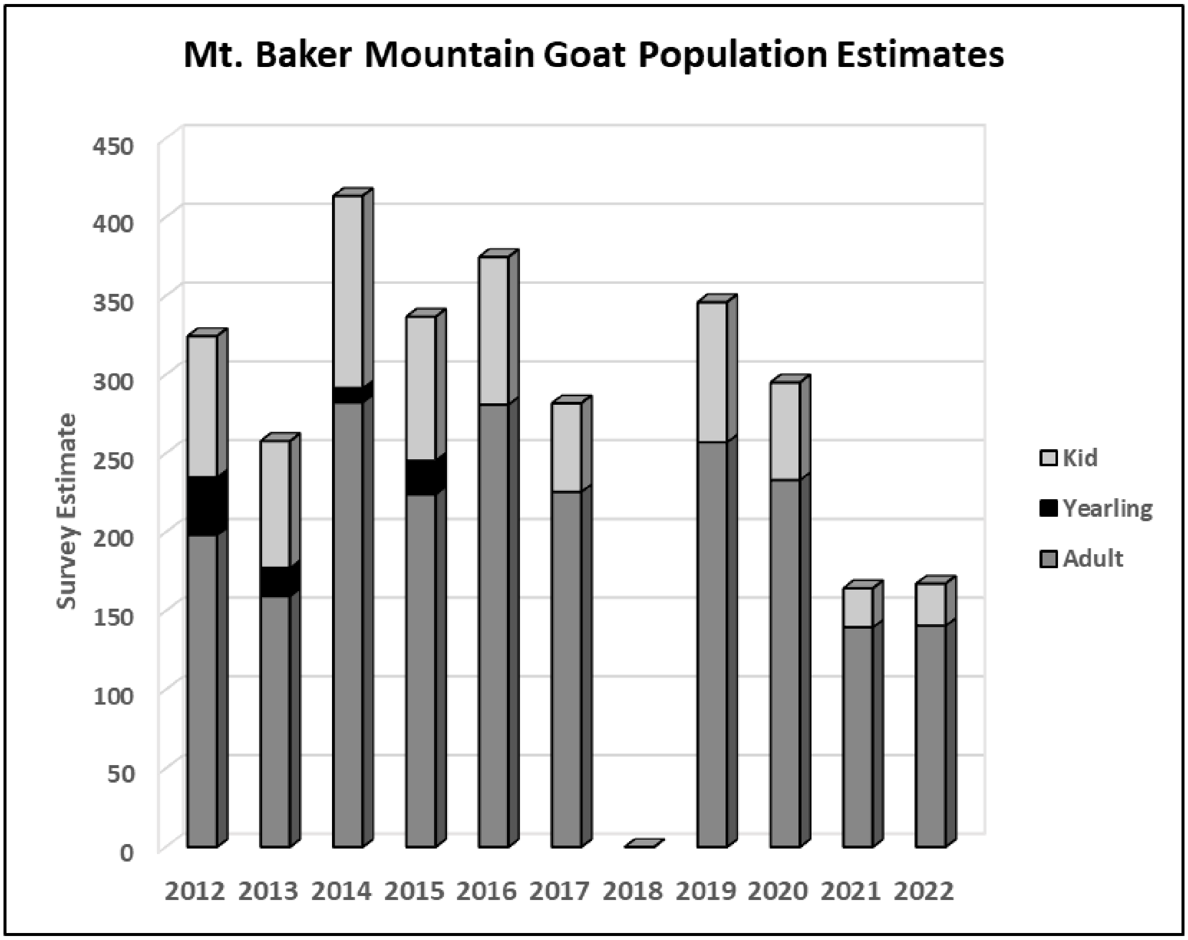

Figure 2. Population estimates from WDFW and Tribal mountain goat aerial surveys in the Mt. Baker Area from 2012–2022. No survey was conducted in 2018. . Beginning in 2019, goats were classified as either an adult or a kid. Estimates are calculated based on numbers derived from the Black Butte, Chowder Ridge, Coleman Pinnacle, Heliotrope, Loomis Mtn., Lava Divide North and South, and Sholes Glacier survey blocks only.

Survival and Mortality

Historically, most information regarding goat numbers and distribution was derived from occasional non-standardized aerial surveys and harvest report cards and questionnaires returned by permitted hunters. The Mt. Baker area originally included goat management units 4-2, 4-3, 4-4, and 4-5 in Whatcom and Skagit Counties. Harvest in these units during 1969–85 totaled 121 animals, with an average of 13 goats harvested per season. From 1986–95, the harvest totaled 26 animals, with an average of six goats harvested per season. By 1996, all the Mt. Baker goat units were closed to hunting due to declines in harvest and low numbers of goats seen during aerial surveys. In 2007, Mt. Baker units 4-3 (Chowder Ridge) and 4-7 (Avalanche Gorge) were reopened with one permit issued per unit. Unit 4-4 (Lincoln Peak) was added later, with a conservative approach, limiting the annual number of permits in 2020 for the Mt. Baker area to six permits. Within the Boulder River North hunting unit, the population appeared stable, with population estimates (not including kids) exceeding 100 animals in all years from 2012 to 2018 (Figure 1). However, recent population estimates from 2020–2022 were lower than previous years, with fewer than 100 animals in the Boulder River North hunting unit.

Habitat

The Mt. Baker area mountain goat population has rebounded substantially since the low abundance in the 1980s and 1990s. However, it needs to be determined whether the increasing trend seen over the past few years will continue or if the population is reaching the capacity of the habitat to maintain goats. The conservative hunting season, reestablished in 2007, appears to have negligible effects on population size, age/sex structure, and population trend.

Most goats in the Mt. Baker area are within the Mt. Baker Wilderness on the Mt. Baker-Snoqualmie National Forest and the adjacent North Cascades National Park. Federal land management restrictions protect habitat qualities critical for maintaining a robust mountain goat population. However, this area has seen increased 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 Mt. Baker/Snoqualmie National Forest. In recent years, this area saw a population rebound similar to the increases in the Mt. Baker unit, suggesting that habitat quality in this area of the North Cascades was sufficient for mountain goats. The significance and cause of the low population estimates from 2020–2022.

The Boulder River North unit needs to be better understood and will require further investigation. The quantity or quality of summer forage resources for goats in alpine terrain is generally poorly understood in the North Cascades. However, fire exclusion and warming climate conditions may negatively impact alpine habitats, and additional research is needed on this topic.

Management Conclusions

From September 2018 to August 2020, WDFW and the National Park Service translocated 325 mountain goats from Olympic National Park to the North Cascades, with an overall survival rate of just above 50%. WDFW will continue to monitor the success of recent augmentations to determine whether this effort will increase population over time. WDFW has no immediate plans to increase mountain goat hunting permits in the North Cascades hunt units.

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Table 1a. Permit numbers, hunters, harvest, hunter success rates, and total days hunted, Mt. Baker and Boulder River North mountain goat hunt units, 2009–2021.

Hunt Unit	Year	Permits	Hunters	Harvest	Success (%)	Days Hunted	# Females Harvested
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	0
	2014	2	2	2	100	5	1
	2015	1	1	1	100	23	1
	2016	1	1	0	0	3	0
	2017	1	1	1	100	1	0
	2018	1	1	1	100	2	1
	2019	1	1	1	100	2	0
	2020	1	1	1	100	1	0
	2021	1	1	1	100	1	0
Lincoln Peak	2009	1	1	1	100	8	1
	2010	2	2	2	100	5	
	2011	2	2	2	100	19	
	2012	1	1	0	0	0	
	2013	1	0	0	0	0	0
	2014	1	1	1	100	4	0
	2015	2	2	2	100	33	0
	2016	2	2	1	50	3	1
	2017	2	2	2	100	6	0
	2018	2	1	1	100	9	0
	2019	2	2	1	50	10	0
	2020	2	2	0	0	12	0
	2021	2	2	1	50	19	0
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	0
	2014	2	2	2	100	17	1
	2015	3	4	3	75	56	1
	2016	3	3	2	50	15	1
	2017	3	3	2	67	18	0
	2018	3	2	2	67	7	2
	2019	3	3	0	0	8	0
	2020	3	3	3	100	5	0
	2021	3	3	1	33	14	1

Table 1b. Permit numbers, hunters, harvest, hunter success rates, and total days hunted Boulder River North Mountain goat hunt units, 2015–2021. ***(Continued)***

Hunt Unit	Year	Permits	Hunters	Harvest	Success (%)	Days Hunted	# Females Harvested
Boulder River North	2015	1	1	1	100	8	0
	2016	1	1	1	100	2	0
	2017	1	1	1	100	2	0
	2018	1	1	1	100	17	0
	2019	1	1	1	100	3	0
	2020	1	1	1	100	12	1
	2021	1	1	0	0	12	0

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 all the way to the Columbia River.

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 2021, the Goat Rocks/Tieton River Unit was aerially surveyed, yielding 156 animals observed (Table 1) and a sightability-corrected population estimate of 166 (90% confidence interval: 154-172; Table 2). The sightability-corrected population of adult mountain goats in that unit was estimated at 113 (90% confidence interval: 105-122). The Smith Creek Unit was surveyed from the air in 2020, yielding a sightability-corrected estimate of 21 goats (90% confidence interval: 15-27; Table 2). In 2020, the second aerial survey of the Mt. St. Helens and Mt. Margaret Backcountry was conducted. A total of 236 goats were observed during the flight, which resulted in a Sightability-corrected estimate of 254 goats (90% confidence interval: 235-273; Table 2). The sightability-corrected population of adult mountain goats in that area was estimated at 201 (90% confidence interval: 188-214). 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 (2005-2021).

Goat Unit	Year	Adult	Kid	Unknown	Total	Kid:Adult
Goat Rocks/Tieton River	2021	105	31	20	156	30:100
	2020	136	35	0	171	26:100
	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	2020	13	3	0	16	23:100
	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	2020	186	50	0	236	27:100
	2017	169	54	0	223	32:100

Table 2. Sightability-corrected Mountain Goat Survey Results – Region 5 (2005-2021).

Goat Unit	Year	Population Estimate (90% CI)
Goat Rocks/Tieton River	2021	166 (154-172)
	2020	181 (170-192)
	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)
Goat Unit	**Year**	**Population Estimate (90% CI)**
Smith Creek	2020	21 (15-27)
	2017	14 (9-18)
	2012	64 (48-79)
	2010	41 (33-49)
	2008	32 (No CI)
Mt. St. Helens/Mt. Margaret	2020	254 (235-273)
	2017	246 (232-260)

Mountain goats were formally surveyed from the ground on Mt. St. Helens and in the associated Mt. Margaret Backcountry in August of 2014-20. The effort involved simultaneous surveys and documentation of all goat groups by multiple teams of observers at pre-arranged stations. The surveys have demonstrated an increasing goat population (Figure 1). In 2020, the ground survey was conducted two days before the aerial survey, and a minimum of 200 mountain goats were counted, which was lower than the Sightability-corrected aerial estimate of 254. Since the aerial surveys have proven to be effective and WDFW is committed to funding them at regular intervals into the future, the ground count has been suspended. The project was a cooperative effort among WDFW, the U.S. Forest Service, the Cowlitz Tribe of Indians, and volunteers associated with the Mt. St. Helens Institute.

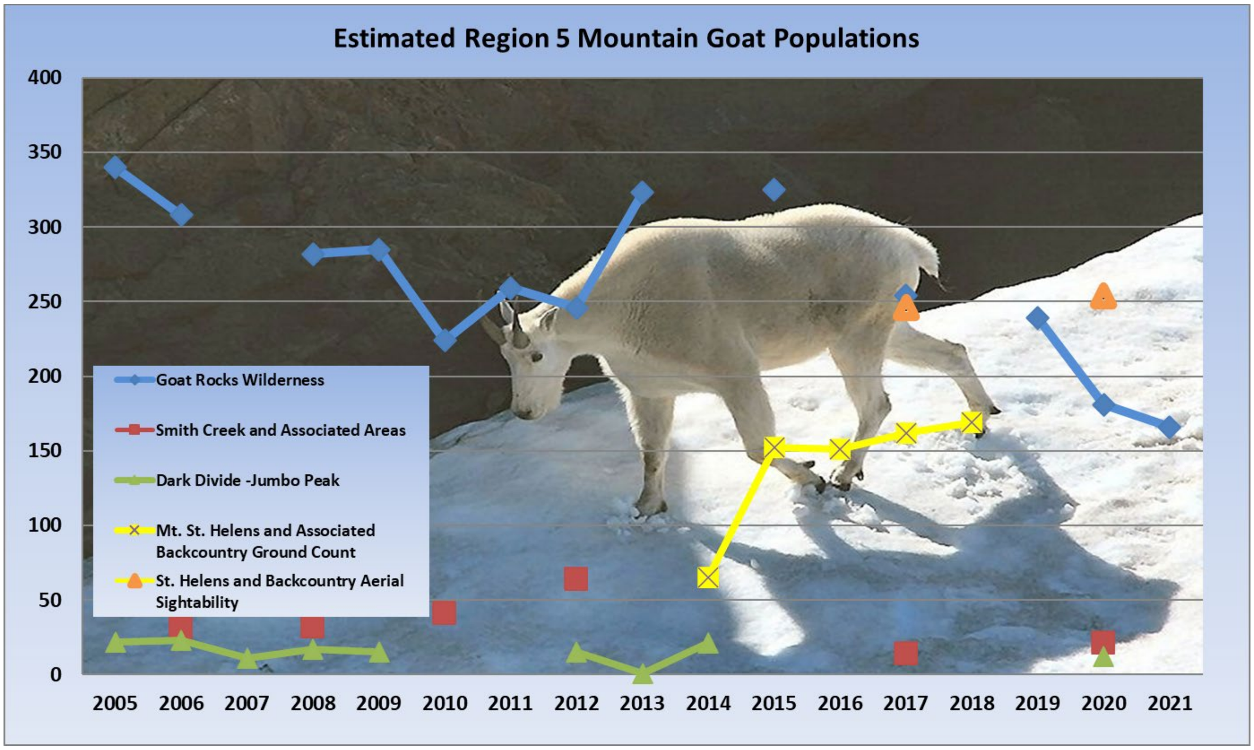

Figure 1. Estimated Region 5 Mountain Goat Populations

No additional mountain goat areas in Region 5 were surveyed from the air during 2021 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 and areas between the 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. A ground survey at Jumbo Peak in the Dark Divide area was conducted by the Unites States Forest Service (USFS) in October 2020, and 12 mountain goats were counted.

Sightability-corrected aerial surveys conducted over the past several years suggest a decline in the Goat Rocks population and a possible decline in the Smith Creek goat population. The back-to-back ground and aerial surveys of the Mt. St. Helens population in 2017 and 2020 indicated that the ground survey is greatly underestimating the total population, and WDFW recommends using the aerial survey method with sightability correction into the future. The ground survey provided critical information on an increasing goat population as well as its distribution and the Department is grateful for all of the partners and volunteers who participated in the effort.

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. The bag limit is one goat of either sex with horns longer than 4 inches. However, hunters are encouraged to shoot billies (males) rather than nannies (females) 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 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, 2014). A goat unit must initially 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 kids) population (WDFW, 2014). 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 aerial surveys 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. These hunts have continued in subsequent years. 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 most of the harvest and hunting pressure is not concentrated in one small area. One tag was offered in the Goat Rocks West Hunt Area and two tags were offered in the Goat Rocks East Hunt Area in 2021. The permit holder in the Goat Rocks West Hunt Area was successful in harvesting a billy (Table 3). The two Goat Rocks East permit holders were not able to hunt due to wildfire closures and their permits were rolled over to the 2022 hunting season. Tribal hunters did not harvest any mountain goats during 2021 in the Goat Rocks population. The 2021 hunting season was the fourth year for permits in the Mt. St. Helens area. One permit each was issued for the Mt. St. Helens South and Mt. Margaret Backcountry Hunt Areas. The Mt. Margaret Backcountry permit holder was successful in harvesting a billy, while the Mt. St. Helens South permit holder was unsuccessful (Table 3). Neither the auction nor the raffle goat permits were used in the Goat Rocks, Mt. St. Helens South, or Mt. Margaret Hunt Areas in 2021.

Table 3. Region 5 Mountain Goat Hunt Summary 2012-2021.

Goat Unit	Year	WDFW Permits Issued	WDFW Permit Harvest	Tribal Harvest[a]	Total Harvest	Total Billies Harvested	Total Nannies Harvested
Goat Rocks	2021	3	1	0	1	1	0
Goat Rocks	2020	4	4	1	5	5	0
Goat Rocks	2019	5	3	4	7	6	1
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
Mt. Margaret Backcountry	2021	1	1	N/A	1	1	0
Mt. Margaret Backcountry	2020	1	1	N/A	1	1	0
Mt. Margaret Backcountry	2019	1	1	N/A	1	1	0
Mt. Margaret Backcountry	2018	1	1	N/A	1	1	0
Mt. St. Helens South	2021	1	0	N/A	0	0	0
Mt. St. Helens South	2020	1	1	N/A	1	1	0
Mt. St. Helens South	2019	1	1	N/A	1	1	0
Mt. St. Helens South	2018	1	1	N/A	1	1	0
[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 disturbances such as avalanches, disease, wind-throw, and fire (Hemstrom, 1979).

Periodic fire is one of the most important factors in creating and maintaining alpine meadows (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 loss of alpine meadows 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. Additionally, fires in the vicinity of Mt. Adams have occurred over the past several years. Another possible avenue to address conifer encroachment is through 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 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-to-nanny ratios of approximately 0.38. In 2017 and 2020, all hunter-harvested goats sampled from the Goat Rocks were negative for *M. ovi*. No harvested goats were sampled in 2021. 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 collaborating with Washington State University veterinary researchers better to 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 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. St. Helens has been a benefit for viewing opportunities at the popular Mt. St. Helens National Volcanic Monument visitor centers and trails. Now, with a population larger than currently found in the Goat Rocks, hunting opportunities are available as well.

The recent decline in the Goat Rocks population is concerning, and warrants continued surveillance for disease in hunter-harvested goats as well as aerial surveys to estimate the population. Increased recreational disturbance and a decline in habitat due to lack of disturbances and conifer encroachment could also be factors affecting this population. It is possible that the harvest of 7 nannies between 2016-18 could also have contributed to the population decline as mountain goat populations tend to be sensitive to the harvest of adult females (Hamel et al., 2006). Consideration of nanny harvest from the previous hunting season(s) may be needed when determining the number of permits allocated during future seasons. A system to account for previous years' nanny harvest was proposed as a Strategy in the 2015-2021 Game Management Plan (WDFW, 2014) but was never implemented.

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.

The continuation of 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 habitats will also play an important role in the expansion of goat populations outside of the Goat Rocks.

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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 1980s, the mountain goat population had reached an estimated 1,175 goats throughout their 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). Mountain goats occupy areas within ONP and on United States Forest Service (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 reemerged. Washington Department of Fish and Wildlife (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. This hunt was closed in 2018.

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 ONP Mountain Goat Management Plan Final 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 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, which is 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 remove mountain goats in the designated permit area (WDFW, 2014).

Population Surveys

The last reported estimate of mountain goats on the Olympic Peninsula was 623 (95% CI = 561-741) goats, including ONP and USFS lands (Jenkins et al., 2016). The estimate of goats for those areas surveyed within the WDFW designated permit hunt area was 59 (95% CI = 53-89) (K. Jenkins, personal communication). When the translocation/removal efforts began, it was projected that there would be at least 725 mountain goats in the Olympics. No surveys have been conducted since then.

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 with a 3-month season (Johnson, 1983). In 1913, the bag limit was reduced to one 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 resumed in 1948 by permit in designated hunt units in Washington. Archery-only goat permit hunts were established for three designated permit units in the Olympics in 1980: the Elwha, Quilcene, and Hamma Hamma. An estimated 168 goats were harvested from 1980 until 1997, when the season was closed.

WDFW established a permit hunt area on USFS lands in the eastern Olympics in 2014. Two permit hunt areas were designated, and three permits were issued per hunt area. In 2015, the two designated permit areas were combined into one large unit, with six permits issued in a split season of three permits each. Hunter success for this hunt averaged 32%. State hunters harvested 15 goats, and Tribal hunters harvested nine goats from 2014-2020 (Figure 1). The WDFW permit hunting season in the Olympics was closed in 2018 due to the removal and relocation efforts, which expanded to include the permit hunt area.

WDFW reopened the eastern Olympic goat permit hunt in 2021. A total of 25 permits spread across three hunt periods were available. Hunters selected for this hunt could harvest up to two goats and hunt anywhere in GMUs 621, 636, and 638. Also, the once-in-a-lifetime restriction was waived for this hunt. Of the twenty-five permits issued, ten hunters spent fifty-seven days hunting mountain goats in the Olympics and harvested one adult male goat.

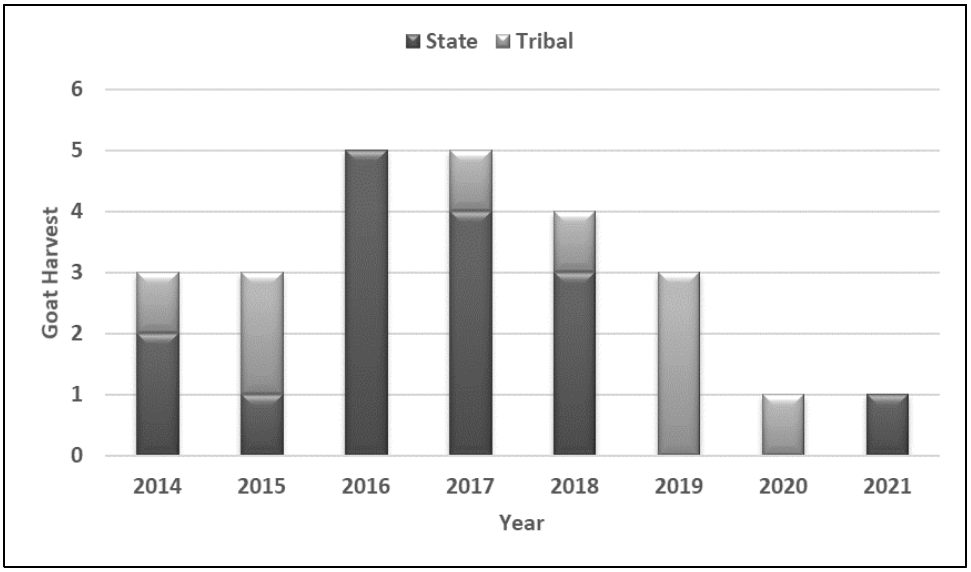

Figure 1. Total State and Tribal mountain goat harvest within the Olympic Mountain Goat Permit Hunt area from 2014 – 2021. There were no State mountain goat hunting opportunities in the Olympics during the 2019 and 2020 seasons.

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. Like 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 the 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 the availability of forage, landscapes that provide high solar loading, and terrain that is rugged, providing an 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). The transition between seasonal ranges generally occurs in June (summer range) and October or November (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 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 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

From 2018-2020, WDFW, ONP, and USFS conducted efforts to remove and relocate mountain goats from the Olympics to the North Cascades. Three hundred eighty-one goats were removed during this phase; 325 were relocated to the North Cascades (Happe et al., 2021). Thirty-two goats were removed from the permit hunt area. A ground-based culling effort took place inside Olympic National Park in 2020 by qualified volunteers, removing an additional 31 goats (Happe et al., 2021).

Aerial culling efforts by ONP were conducted in 2021 and 2022. Two removal periods were conducted during July and August each year. In 2021, 113 goats were removed, four were taken from USFS lands, and the remainder were taken from within ONP. In 2022, 23 goats were removed, with 14 of these coming from USFS lands at Mount Ellinor and the Brothers.

It is thought that only a few goats remain, and there are no specific additional removal efforts planned. Instead, future removals will occur over the next 15 years on an opportunistic basis by ONP staff. Hunting outside the Olympic National Park may also occur.

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. As part of a long-term plan to address these concerns, strategies to reduce the number of mountain goats in the Olympics were initiated. The Department established the goat conflict reduction permit hunt on USFS lands in the eastern Olympics in 2014 and continued this hunt through 2018. From 2018-2020, the ONP, USFS, and WDFW conducted a removal and relocation effort of mountain goats from the Olympic Peninsula to the North Cascades. In 2020, ONP conducted a ground-based culling effort within the Park. Tribal hunting on USFS lands has also contributed to the goat reduction effort. The ONP conducted aerial removal activities in 2021 but did not operate in much of the State designated permit hunt area on USFS lands to allow a state permit hunt opportunity to proceed during the 2021 season. The ONP is conducting a similar aerial removal effort in 2022 but will expand its area of operation to include all USFS lands where goats are found, including the permit hunt area. Thus the 2022 Olympic goat permit hunt was closed.

Management Conclusions

Surveys conducted in 2016 estimated there were 623 (95% CI = 561-741) goats on the Olympic Peninsula, including ONP and USFS lands, and the population was growing (Jenkins et al., 2016). Since 2014, an estimated 570 goats have been removed from the Olympic Peninsula through a combination of State hunting, Tribal Hunting, the capture-relocation project, and ground-based culling.

Efforts to reduce the number of goats in the Olympics will continue. The capture and relocation phase of the goat reduction plan concluded in 2020. In 2022, the ONP will conduct the last round of aerial culling activities throughout the Olympic Mountain range. Additional mountain goat removal activities will be conducted after 2022 on a case-by-case basis as goats are encountered.

The permit season was closed for 2022. Future permit hunts will be recommended if any mountain goats remain in areas outside of the ONP.

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Bighorn Sheep

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 the Washington Department of Fish & Wildlife, the Idaho Department of Fish and Game, the Oregon Department of Fish and Wildlife, the U.S. Forest Service, the Bureau of Land Management, and the Wild Sheep Foundation. 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. 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 landowner tolerance can be resolved. For the Tucannon herd, the 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, the 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 area's potential was estimated to be 240 animals. The short-term objective for the Black Butte herd was 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; biologists estimate that ideally, the area could support approximately 1,360 if disease and landowner tolerance issues were resolved.

Population Surveys

Aerial surveys have not been conducted since 2015 because systematic mark-resight ground counts have proven adequate for estimating population parameters. Ground counts were obtained for two of the five herds during March and April of 2022, with an attempt on a third (Asotin) that weather prevented from completion. The other two herds were not surveyed, but frequent monitoring for research has provided information to generate an estimate. The population estimate for 2022 (for all herds aggregated) was 508 bighorns. Herd composition consisted of 247 ewes, 112 lambs, and 128 rams, with resulting ratios of 52 (95% CI: 41-63) rams and 44 (95% CI: 34-54) lambs (just prior to them becoming yearlings) per 100 ewes (Table 1). A number of bighorns from Mountain View, Wenaha, and Black Butte inhabit Oregon throughout the year. Lamb recruitment during the 2021-2022 biological year continued to improve from the previous year for the herds within the Grande Ronde Watershed (Black Butte, Mountain View, and Wenaha). This is likely due to higher lamb survival as a result of removing chronic *M.ovi* shedders in the previous years.

Hunting Seasons and Recreational Harvest

Recreational hunting opportunity was limited to one raffle permit and two draw permits in 2021. The permit issued for the Wenaha herd was returned when fires closed access to the unit before the season started. Poor recruitment (past years), disease risk and conflict removals, interstate management, and tribal harvest continue to limit the available recreational opportunity within Washington. One ram was harvested from the Black Butte and Mountain View herds in 2021. Efforts are being made to work with local tribes with treaty rights to coordinate and agree upon the current harvest opportunity to allow for the recovery of the male segment of the population. The Nez Perce Tribe does not collect or report harvest. WDFW and the Nez Perce Tribe have agreed to a hunting moratorium in the Asotin herd until the herd recovers from a disease outbreak and poor recruitment and survival. WDFW, the Oregon Department of Fish and Wildlife, and the Confederated Tribes of the Umatilla Indian Reservation have collaborated for five years in managing harvest in the Wenaha herd, which covers two states and two treaty tribes' areas.

Survival and Mortality

Survival analysis has not been completed at this time for the 2021-2022 biological year. The Hells Canyon Restoration Committee will produce a report periodically 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), the range appears to have recovered. Noxious weeds are not dominating the landscape in the core bighorn range, and the grasses and forbs appear healthy. During the summer of 2015, the Grizzly Complex wildfire burned a large portion of the Wenaha herd range. It still needs to be determined what effect this may have on the habitat within this herd range. In 2021, a fire burned portions of Joseph Canyon in Oregon and Washington within the Black Butte herd range, and a large fire burned more than 90% of the Asotin herds' home range. A very wet spring occurred in the spring of 2022 which has led to rapid recovery of grass and shrub communities burned the previous summer.

Human-Wildlife Interaction

Bronchopneumonia caused by, or facilitated by, the bacteria *Mycoplasma ovipneumoniae* (*M. ovi*, hereafter) has affected four of the five Blue Mountain bighorn populations in Washington: Asotin, Black Butte, Wenaha, and Mountain View. Bighorn populations in the Hells Canyon area (which includes the Washington Blue Mountain herds, but also nearby herds in Oregon and Idaho) generally 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 the bighorn sheep range presents a constant and substantial risk of another major epizootic. WDFW actively works with landowners near bighorn sheep herds to ensure 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 goats 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 seven 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, which appears to have shown positive results as seen with a major improvement in lamb recruitment post-treatment. This management approach has been called the “Test and Remove” action. Although the Asotin herd has been cleaned of M.ovi., other stochastic events have decreased survival rates of all age classes, preventing population recovery.

In 2019, a cooperative research project with Idaho Fish and Game, the University of Idaho, and the Washington Department of Fish and Wildlife was initiated within the Asotin herd. The primary aim in Asotin Creek is to uncover links between behavior (e.g., use of the nutritional landscape) and demography (e.g., lamb survival) of sheep occupying arid, low-elevation habitats. In the late summer of 2020, 2021, and 2022, researchers visited six 100-m vegetation phenology transects to track the availability and succession of plant species across the study areas. Furthermore, they continued collecting fecal pellets and vegetation data to assess diet composition and plant species available throughout the summer.

Researchers continued monitoring collared lambs captured in 2020, 2021, and 2022. Causes of mortality will be evaluated to determine linkages between available nutrition, disease status, dam condition, and movement.

In the fall of 2019, 2020, and 2021, researchers attempted to re-capture all marked females and capture new adults to compensate for mortalities that had occurred over the prior year. Results from this work should be available in the spring of 2024.

Management Concerns

Disease, predation, and harvest 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. However, recent developments in identifying chronic carriers of *M. ovi*. have provided opportunities to treat multiple herds. *M. ovi*. has been the limiting factor for population growth in the Blue Mountains for more than 20 years. As of 2018, all herds in southeast Washington are thought to be free of M.ovi, with growth rates of the Black Butte, Mountain View, and Wenaha herds reflecting this positive change.

Three government entities within the Washington Blue Mountains have harvest rights to the bighorn sheep herds (WDFW, Confederated Tribes of the Umatilla Indian Reservation, and Nez Perce Tribe). These three 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 goal.

Management Conclusions

Four of the five bighorn sheep herds in the Blue Mountains have struggled with *M. ovi*-induced bronchopneumonia, but with recent management actions, no bighorn documented *M. ovi*. positive animals have been detected in four years. This is likely a result of the “test and remove” management actions by the Hells Canyon Restoration committee. The multi-state effort to remove chronic shedders of the *M. ovi*. bacteria while monitoring “cleaned” herds 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, among other uses, 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. The ability to capture and receive M.ovi. test results back in less than 24 hours has improved greatly over the past 5 years. This has led to an approach that reduces the number of bighorns lethally removed who may have been in contact with domestic caprinae. The current management approach is to attempt to capture bighorns in high-risk locations, test, hold in a horse trailer, and release into the origin herd with a collar if found negative for M.ovi. This has reduced lethal removals by 90% since 2017.

			Rams						Population	Ratio (90% CI)	
Year	Lambs	Ewes	C I	C II	C III	CIIIB	C IV	Total	Total	Lambs	Rams
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 (42, 65)
2019	78	154	33	33	37	3	3	94	327	51 (39, 62)	61 (48, 74)
2020	60	152	1	0	2	0	0	95	307	39 (30, 49)	62 (49, 76)
2021	91	210	15	34	43	7	6	140	446	43 (34, 52)	66 (54, 78)
2022	105	240	6	20	24	10	1	125	491	44 (34, 54)	52 (41, 63)

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
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)
2020	11	33						20	64	33 (14, 52)	60 (32, 88)
2021	14	32	3	4	6	1	2	28	75	43 (21, 67)	87 (50, 125)
2022	15	25						17	65	60 (22, 98)	68 (18, 118)

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
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)
2020	5	11						22	38	45 (5, 86)	200 (78, 321)
2021	4	16	5	3	5	1	2	20	45	25 (2, 48)	125 (56, 193)
2022	12	34						22	80	35 (12, 58)	64 (30, 99)

Table 3. Black Butte herd 10-year survey history

			Rams						Population	Ratios (90% CI)	
Year	Lambs	Ewes	CI	CII	CIII	CIIIB	CIV	Total	Total	Lambs	Rams
2013	12	54	1	8	15	1	3	28	94		
2014	16	65	2	7	9	1	2	21	102		
2015	17	67	11	7	5	2	2	27	111		
2016	37	70	2	1	4	0	0	38	145		
2017	38	97	9	10	10	0	7	38	210		
2018	43	95	13	18	12	2	0	53	190		
2019	52	94	22	27	17	2	2	55	202		
2020	38	97	0	0	0	0	0	50	185		
2021	65	148	6	26	31	5	2	89	301	44 (33, 55)	60 (47, 73)
2022	78	181	6	20	24	10	1	86	346	43 (32, 55)	48 (35, 60)

Table 4. Mountain View and Wenaha herd 10-year survey history.

			Rams						Population	Ratios (90% CI)	
Year	Lambs	Ewes	CI	CII	CIII	CIIIB	CIV	Total	Total	Lambs	Rams
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)
2020	6	11	1	0	2			3	20	55 (9, 100)	27 (0, 56)
2021	8	14	1	1	1			3	25	57 (15, 99)	21 (0, 44)
2022	7	7		1	2			3	17	100 (0, 205)	43 (0, 101)

Table 5. Tucannon herd 10-year survey history.

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Bighorn Sheep Status and Trend Report: Region 1

Hall Mountain and Vulcan Mountain

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Introduction

District 1 has two bighorn sheep populations, both resulting from reintroductions. Rocky Mountain bighorn sheep were introduced to Hall Mountain in Pend Oreille County, Washington, from Alberta, Canada, in 1972 (Johnson, 1983). The founder herd included five rams and 13 ewes. In 1981, two 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 two rams and six ewes, were translocated from the Colockum State Wildlife Area to the 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 the updated mapping of suitable habitats. 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, these population objectives have also recently been revised to reflect updated mapping of suitable habitats. Short-term early winter herd objectives for the Vulcan herd are from 70-90 animals. Long-term, biologists estimate that the Vulcan area could support 80-110 animals.

Population Surveys

The Kalispel Tribe conducted two aerial surveys of the Hall Mountain herd in April and June 2021. The aerial surveys yielded a minimum of ten sheep (three ewes, no lambs, three yearlings, and four rams). Table 1 summarizes the maximum number of sheep observed during aerial surveys.

The Vulcan herd is surveyed annually with ground-based surveys conducted along an automobile route on county roads and from private and primitive roads. During the survey, biologists attempt to classify every detected bighorn sheep. However, they recognize that the effort likely never results in a complete count, and classification is not possible for animals at extreme distances. In 2021, a ground-based survey was conducted in October by WDFW, and no aerial surveys were done. Using the highest count for each classification, WDFW biologists observed 25 bighorn sheep (17 ewes, four lambs, and zero rams; Table 2).

Table 1. Counts of Hall Mountain bighorn sheep, 2001-2021.
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
2020	2	5	1	10	40:100:20
2021	0	3	4	10	0:100:133

*** Total counts some years include unclassified bighorn sheep.**
**** Ground-based surveys conducted in spring before translocation of NBR sheep.**

Table 2. Annual population composite counts of the Vulcan Mountain bighorn sheep, 2001-2021.

Year	Lambs	Ewes	Yearling	--- Rams ---			Total*	Lambs:100 Ewes: Rams
				<3/4 curl	>3/4 curl	All 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
2017**	10	26	1	6	12	19	55	38 : 100 : 73
2018	13	22	5	12	4	16	56	59 : 100 : 72
2019	8	23	0	7	6	13	44	35 : 100 : 57
2020	8	18	3	18	8	26	55	44: 100 : 144
2021	4	17	4	0	0	0	25	24 : 100 : 0

*** 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 raffle permit hunt; however, no bighorn sheep have been 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. Department and Tribal biologists annually confer prior to developing their respective permit recommendations, with one state permit allocated for 2021 and one ram harvested.

Survival and Mortality

Predators throughout the Hall Mountain herd area include coyotes, black bears, cougars, and gray wolves. Using a Kaplan-Meier survival estimator for the translocated Bison Range sheep, survival during their first year at Hall Mountain was estimated to be 0.50, and the cause of mortality was known for three sheep. Two of the translocated sheep were dispatched, as a precaution, by WDFW after they left the release site and had the potential to interact with domestic sheep and goats, and the third was attributed to a cougar. After censoring the two dispatched sheep from the analysis, the median survival during the first year at Hall Mountain for the remaining eight was 0.625. Because of the very low sample size, these estimates should be viewed cautiously, and no conclusions should be made about the leading causes of mortality for the sheep at Hall Mountain.

Coyotes, black bears, cougars, and gray wolves are predators throughout the Vulcan herd area. In 2019, one mortality (ewe) was documented among seven radio-collared sheep. The mortality was classified as unknown due to the amount of time elapsed before retrieving the collar.

Table 3. Summary of State permit numbers and State hunter harvest of bighorn sheep from the Vulcan Mountain Unit, 2005-2021.

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
2019	1	1 ram
2020	0	None
2021	1	1 ram

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 forests 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 are no domestic livestock grazing within the national forest area used by the Hall Mountain bighorn sheep.

Several projects to enhance the 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), Safari Club International (SCI), Inland Northwest Wildlife Council (INWC), USFS, Bureau of Land Management (BLM), and 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, ten short-yearling (born in spring 2015) bighorn sheep (eight ewes, two 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, eight 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, four 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 and corresponding updates of the study are as follows:

1. Estimate ewe and lamb abundance with the assistance of VHF telemetry during multiple helicopter flights.
    a. Unfortunately, the helicopter vendor that is used (closest to Hall Mountain, affordable) has not outfitted their helicopters for aerial telemetry. Without this capability during surveys, observers were not able to locate sheep in real-time, and therefore the collars did not help biologists find additional sheep. Last collar locations were used to navigate to and survey for additional sheep, but in the heavily timbered environment, this proved moderately successful. As of this writing, there are no functioning collars left in the Hall Mountain herd.
2. Determine adult and lamb (up to one year) survival rates and, when possible, cause-specific mortality of radio-collared adult sheep.
    a. Adult survival could not be calculated because no resident sheep were captured on Hall Mountain.
    b. Annual survival (first year after translocation) was calculated using a Kaplan-Meier survival estimator (see results in the Survival section above).
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 (U.S. Selkirk Mountains) and the B.C. Selkirk Mountains.
    a. The USFS bighorn sheep habitat prediction model seems to be accurate for the Hall Mountain population's range and is consistent with how sheep are using the landscape. Of the summer GPS collar locations for the NBR sheep, 326 of 444 (73%) fall within 200 m of the USFS predicted summer habitat. The BC ram that crossed into the US multiple times since 2018 was documented as far south as Gypsy Peak, but these visits to the US never lasted longer than a few days. Radio-collared sheep indicate that some Hall Mountain sheep move into the Gypsy Peak area/Salmo Priest wilderness in the summer while others remain on Hall Mountain. All collared sheep spend the winter on Hall Mountain.
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.
    a. This has not been completed. Biologists suspect that genetic diversity is not an issue since the influx of 10 new sheep from the NBR (2M and 8F).
5. Assess the general health of Hall Mountain and BC bighorn sheep. Conduct disease testing, pregnancy tests, check for external parasites, and determine body condition (via ultrasound).
    a. Sheep at Hall Mountain never acclimated to the baiting site, and no captures were attempted. All NBR sheep and those collared in BC tested negative for *M. ovi*.

In February 2016, WDFW, with assistance from Leading Edge Aviation, captured seven 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, eight radio-collared sheep were added to the Vulcan herd from the Cleman Mountain herd in 2017. Radio-collared ewes were used to locate lambs and assess recruitment into the population. In addition, the collars aided biologists in finding sheep during helicopter surveys. The collars have almost all failed, and very few of them are reliably sending GPS locations and VHF signals.

Management Concerns

The growth of the Hall Mountain bighorn sheep herd appears to be limited, and habitat seems to be the cause. 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 are a concern. Winter surveys indicate that 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 due to complications from exceptionally high internal parasite loads. Domestic goats were known to share part of the Vulcan bighorn sheep range. The parasite *Muellerius capillaris* using slugs and snails as intermediate hosts, could jump from domestic goats to 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 herd's overall health was acceptable. Nevertheless, biologists know of at least two 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. In 2021, bluetongue was found as the cause of mortality for bighorn sheep in Okanogan County. It does not appear that bluetongue impacted the Vulcan Mountain bighorn sheep herd, but this is difficult to verify without GPS collars.

Management Conclusions

More intensive research could help the Department better understand the dynamics of the Hall Mountain herd and determine the future potential of sustaining and increasing this herd.

The decline observed in the Vulcan herd 2009-2012 was of considerable concern, but there is evidence (survey numbers) that the population was increasing. The minimum population dipped in 2021, but this could have been the product of fewer surveys and not a change in abundance. WDFW is unlikely to be able to use the GPS-collared animals for monitoring, and an increase in aerial and ground surveys will be necessary for monitoring the status of this population.

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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 seven 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. Incidental 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. 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, and one in late fall to assess ram numbers (Table 1). 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 in 2007-2014, after which it stabilized (Figure 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 two 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. Since 2014 ram numbers have steadily declined (Figure 1). The total number of bighorns observed on the 2021 flight, including lambs, was 96 (19 rams, 52 ewes, and 25 lambs). No aerial survey was conducted in 2020 due to COVID-19.

Table 1. Lincoln cliffs herd lamb and ram to ewe ratios, 2012-2021. Lamb:Ewe ratios prior to 2014 based on Spring flight data. Ram:Ewe ratios prior to 2014 based on Fall flight data. Only Fall flights conducted from 2014 onward. No aerial survey was conducted in 2020.

Year	Ewes (Spring/ Fall)	Lambs (Spring/ Fall)	Lambs :100 Ewe	Lower 90% CI	Upper 90% CI	Rams (Spring/ Fall)	Rams :100 Ewe	Lower 90% CI	Upper 90% CI
2012	37/49	12/20	32	14	50	11/21	43	25	61
2013	34/55	18/31	53	28	78	26/32	58	37	79
2014	49	7	14	5	23	38	78	50	106
2015	39	24	62	36	88	29	74	44	104
2016	47	31	66	41	91	29	62	38	86
2017	48	22	46	27	65	25	52	31	73
2018	49	19	39	22	56	20	41	23	59
2019	45	23	51	29	73	26	58	35	81
2021	52	25	48	29	67	19	37	21	53

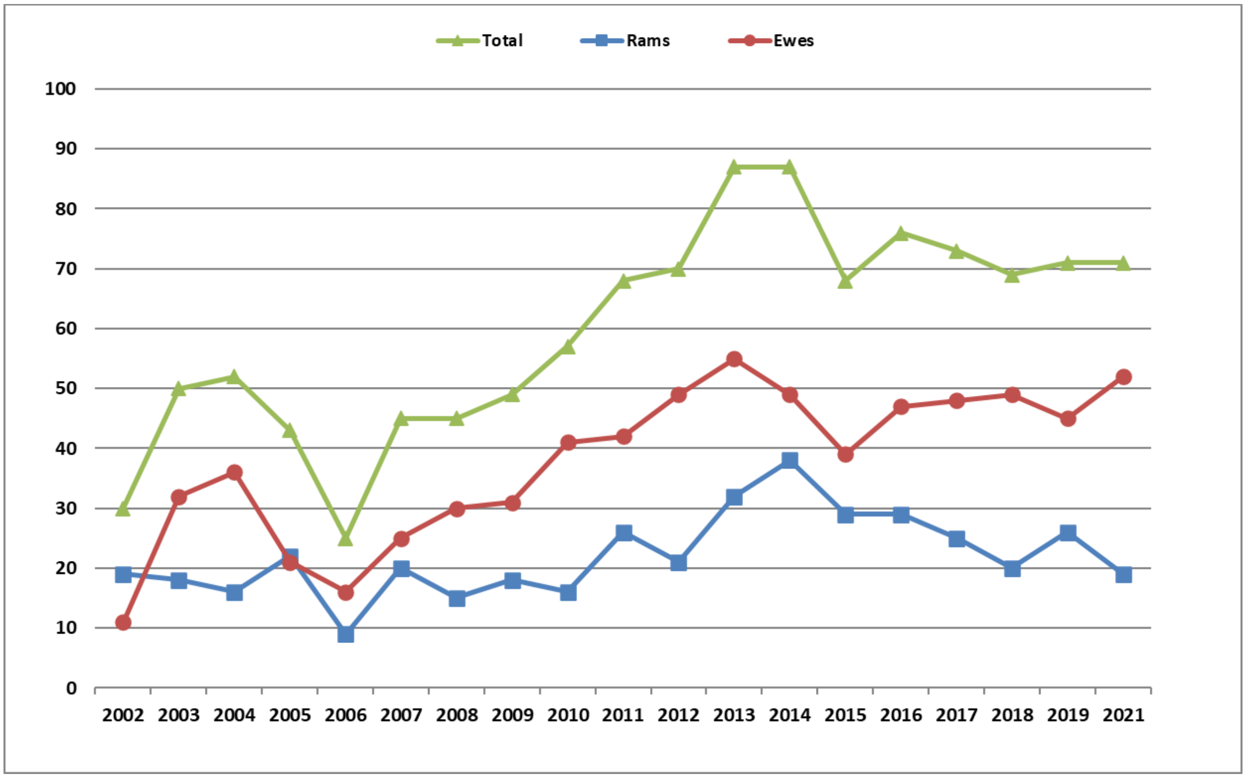

Figure 1. Lincoln Cliffs minimum population estimate by sex for 2002-2021. Shown are the maximum count from all helicopter surveys conducted each year, beginning in 2002, the year regular helicopter surveys were initiated. No aerial survey was conducted in 2020.

Herd composition results from the aerial surveys have varied from 37 to 78 rams per 100 ewes over the last ten years (Table 1). The lambs per 100 ewe ratios have remained relatively stable, although yearly 90% confidence intervals are large (Table 1). The exception was in 2014 when concerns were raised as only seven 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) indicates 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, and 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. Ewe hunts were introduced in 2018, with one permit available for the Lincoln sub-herd and one for the Whitestone sub-herd. This was reduced to one ewe permit, for the Whitestone sub-herd only, in 2020.

Ram permittees have spent an average of five days hunting per kill; however, days hunted has varied widely from one 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 been 100% for this hunt, which had 2,045 applicants in 2021. The two 2021 ram permittees reported a combined 14 days of hunting, and the ewe permittee did not report.

Survival and Mortality

Since 1997, 57 known sheep mortalities (42 rams, 15 ewes) have been documented in this herd: 34 from hunting, two from vehicle collisions, seven from cougar predation, and 14 from unknown causes. No non-hunting mortalities were reported in 2021. One non-hunting mortality, a ewe suspected to have fallen, was reported in May 2020. Prior to this, 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, spring of 2019, and fall of 2020. It is unknown if lamb and 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 the sheep frequent landscaped residential areas.

Human-Wildlife Interaction

Damage complaints related to bighorns occur in both the Lincoln and Whitestone areas. With the growth of this herd, agricultural activities adjacent to escape terrain, and recent drought conditions, some local producers experience 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 the 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 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 the risk of collision is significant. This action did not move forward due to liability concerns by the county.

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 five from Kamloops, British Columbia, in 1996. The population steadily increased 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 one 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 the 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, one ram, and two lambs). There have been no augmentations to this population since 2003.

Research

In February 2015, ten sheep (eight ewes and two 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 in this capture aided the sheep's location during lamb monitoring and 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 large forays out of the known use area during their collar lifetime.

To date, one known mortality has occurred for the ten 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. Although not transmitting, six collared ewes and one collared ram were observed during the 2019 survey flight. Three collared ewes and one collared ram were observed from the ground in Lincoln during the winter of 2020, and four collared ewes and one collared ram were spotted on the 2021 flight.

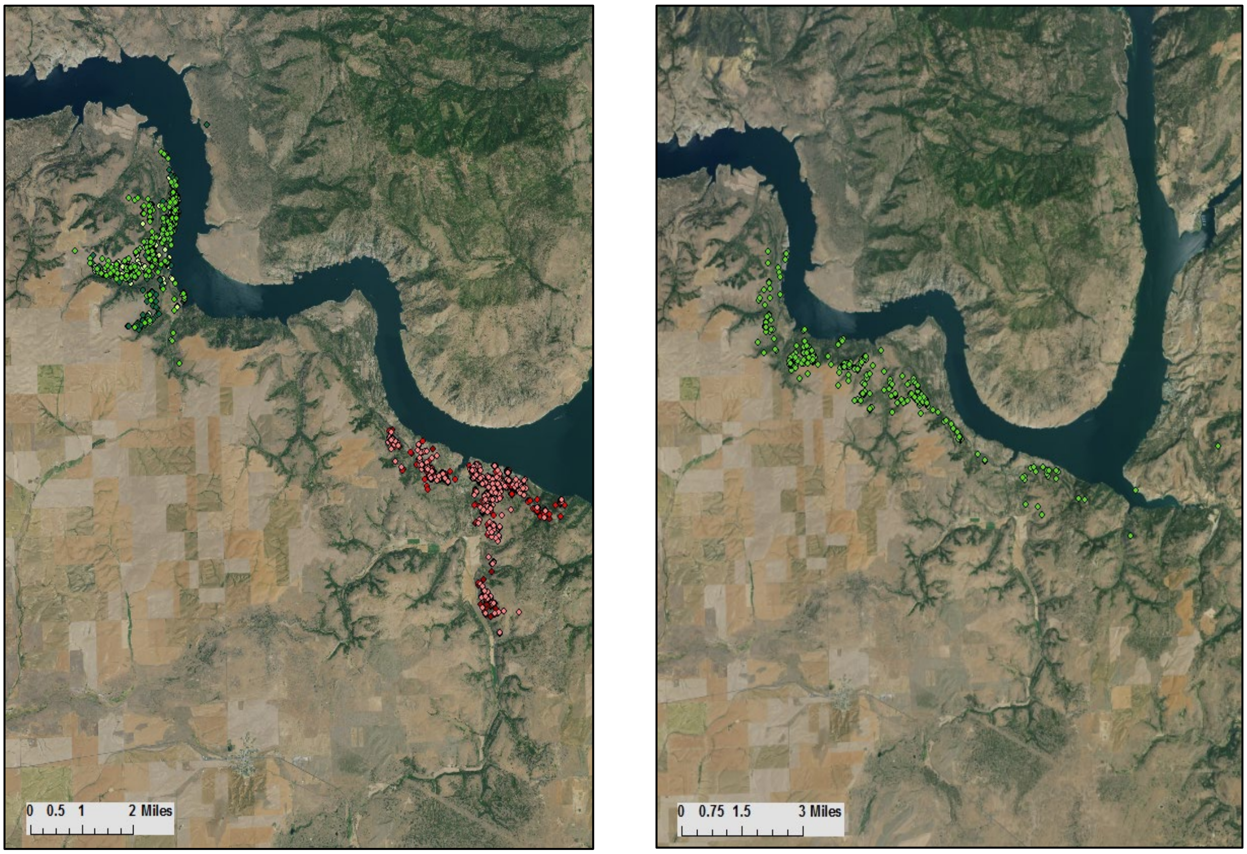

Figure 2. Left-hand panel: Radio locations for 6 Lincoln Cliffs bighorn ewes August 2016-July 2017. Whitestone ewes (3) are in green; Lincoln ewes (3) are in red. Right-hand panel: Radio locations for Whitestone ram August 2016-July 2017 in green.

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 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, over 200 bighorn sheep are 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. In past years, 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 to minimize the risk of an outbreak. GPS collar data has allowed WDFW to delineate better 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. Lincoln Cliff's sheep live 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 the 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 the future management of this herd. Outreach to residents and local producers should continue as management decisions are considered. The 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 first time for the 2018 season, one in the Lincoln sub-herd and one in the Whitestone sub-herd. Two ewe permits were issued again for the 2019 season, and in 2020 this was reduced to one permit in the Whitestone sub-herd.

Bighorn Sheep Status and Trend Report: Region 2

Mt. Hull and Sinlahekin

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Management Guidelines and Objectives

Mt. Hull Herd

The overall objective for the Mt. Hull herd is to maintain a self-sustaining population of around 100 animals that can support both hunting and wildlife viewing opportunities, while remaining within the capability of the limited land base to support it. The short-term management priority is to monitor the current *M. ovi* pneumonia outbreak and its effect on herd demographics. Efforts to minimize contact with domestic sheep and goats and reduce agricultural damage and associated roadkill continue.

Sinlahekin Herd

The overall objective for the Sinlahekin herd is to increase bighorn sheep numbers to at least 50-80 animals capable of supporting both hunting and wildlife viewing opportunities. A current management priority is improving the monitoring of herd demographics and assessing the effects of the ectoparasitic mite *Psoroptes ovis* on the herd.

Population Surveys

Population surveys are generally conducted annually to determine the composition and trend of both the Mt. Hull and Sinlahekin herds (Tables 2 & 3). The surveys are conducted in late fall or winter and consist of helicopter and ground count efforts. An attempt is made to classify all sheep in each herd. Although a complete count is generally not achieved, the result represents a minimum count from which a population estimate is generated.

Mt. Hull Herd

Biologists from the Confederated Tribes of the Colville Reservation (co-managers) conducted an aerial survey of the Mt. Hull Unit in February 2022, classifying 50 sheep (26 ewes, three lambs, and 21 rams). This yielded a lamb:ewe:ram ratio of 12:100:81 (Table 2).

Sinlahekin Herd

WDFW biologists conducted an aerial survey of the Sinlahekin Unit in December 2021, classifying 19 sheep (13 ewes, one lamb, and five rams). This yielded a lamb:ewe:ram ratio of 8:100:38 (Table 3).

Hunting Seasons and Recreational Harvest

Mt. Hull Herd

Permits are split between the Washington Department of Fish and Wildlife (WDFW) and the Confederated Tribes of the Colville Reservation (CTCR). Table 1 shows permit levels and harvest success during 2010-2020. Since 2019, WDFW and the CTCR did not issue any harvest permits due to the discovery of pneumonia in the herd and the unknown population effects.

Sinlahekin Herd

In past years, herd demographics supported the issuance of one ram permit annually from 2010 through 2012, and hunters successfully filled all 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.

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

Year	WDFW Permits	WDFW Harvest	CCT[a] Permits	CCT[a] Harvest
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 * ewe
2018	1 ram 2 ewe	0 ram 1 ewe	1 any 2 ewe	* ram * ewe
2019-2021	No permits issued			

[a] CCT=Colville Confederated Tribes * Not Reported

Survival and Mortality

Mt. Hull Herd

Observational data suggest that the Mt. Hull herd grew steadily following initial reintroduction in 1970 until the herd size reached around 100 animals by the 1990s. Since then, the population has fluctuated in response to fires, weather, and other factors but generally remained around 100 sheep. In 2001, WDFW augmented the herd with eight ewes and three rams from the Cleman Mountain herd. Additional augmentation occurred in 2003 with five animals from John Day, Oregon. Augmentation efforts are primarily designed to maintain genetic diversity. Population growth is achieved largely through natural production.

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).

Year	Lambs	Ewes	Rams			Unknown	Count Total	Population Estimate	L:100:R
			<3/4	≥3/4	Total				
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	--	23:100:54
2019	11	42	15	2	17	0	70	70-80	26:100:40
2020*	5	50	22	9	37	0	92	100+	10:100:74
2021*	3	26	8	13	21	0	50	50-60	12:100:81

***CCT=Colville Confederated Tribe Survey**

When herd size surpassed 100 animals in the mid-2000s, roadkill became an issue as sheep regularly began crossing state highway 97 to forage on irrigated agriculture. In response, WDFW and the Colville Confederated Tribes established some ewe permits. They translocated some sheep from Mt Hull to the Hell’s Gate herd on the Colville Reservation to stabilize the Mt Hull herd size. These actions and some private land management changes have significantly reduced roadkill occurrence.

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. Monitoring of the herd did not show an extensive die-off due to *M. ovi* infection at the time. In July 2021, a male lamb tested positive for *M. ovi*, confirming that the bacterium was still in the herd. The *M. ovi* outbreak continues in the Mt Hull herd and connected herds to the north in Canada.

An outbreak of bluetongue disease in late summer 2021 caused an unknown amount of mortality within the Mt Hull herd. This bluetongue disease outbreak likely played a significant role in the 46% population decline surveys from 2020 and 2021.

Sinlahekin Herd

Initially, the herd grew rapidly following reintroduction in 1957. High productivity and continued expansion allowed for the 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 ten animals to improve genetic diversity and bolster production. Post-augmentation, the herd expanded its range and grew steadily through 2011.

During a 2011 capture effort, Psoroptic mange was discovered in the Sinlahekin herd, and a similar Psoroptic outbreak was documented to the north in adjacent Canadian herds. In 2012, surveys detected poor lamb production and a dramatic decrease in the population, with Psoroptic mange likely a significant contributing factor in the decline. Similar trends were documented in the connected Canadian population. Since 2012, herd size has fluctuated up and down but has not returned to pre-Psoroptes levels. Other potential mortality factors, such as *M. ovi* or heavy predation, have not been detected in the Sinlahekin. However, the heavy Psoroptes infestation is still widespread in the herd and remains the leading candidate to explain the stagnated herd demographics.

An outbreak of bluetongue disease in late summer 2021 caused an unknown amount of mortality within the Sinlahekin herd. This bluetongue disease outbreak likely played a role in the 21% population decline surveys from 2020 and 2021.

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).

			Rams				Count	Population	
Year	Lambs	Ewes	<3/4	>3/4	Total	Unknown	Total	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	15:100:38
2006	3	24	2	3	5	0	32	35-40	12:100:21
2007	2	37	5	7	12	0	51	50-60	15:100:32
2008	7	21	2	3	5	0	33	35-40	33:100:24
2009	15	48	14	9	23	0	86	90-95	31:100:48
2010	15	31	9	5	14	7	67	70-90	48:100:45
2011	4	55	18	5	23	0	82	90-95	7:100:42
2012	2	15	2	0	9	0	26	30-35	13:100:60
2013	4	29	3	2	5	0	38	40-45	14:100:17
2014	7	16	2	2	4	0	27	30-35	44:100:25
2015	11	41	8	3	11	0	63	65-70	27:100:27
2016	--	--	--	--	--	--	--	--	--
2017	3	7	6	1	7	5	22	--	21:100:50
2018	--	--	--	--	--	--	--	--	--
2019	--	--	--	--	--	--	--	--	--
2020	5	11	4	4	8	0	24	25-30	45:100:73
2021	1	13	4	1	5	0	19	20-30	8:100:38

Habitat

Mt. Hull Herd

The Mt. Hull range has generally remained in good shape. The Rocky Hull fire in 2000 rejuvenated a large portion of the area, but noxious weeds and conifer encroachment remain a concern. In 2020, the US Forest Service Tonasket Ranger District began aggressively addressing these issues by thinning 704 acres of conifer forest. Additional conifer removal, pre-scribed fire, and noxious weed treatments are planned.

Radio collar telemetry 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, to the north. DNA testing of the Omak Lake herd indicated that 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

In the second half of the twentieth century, fire suppression and associated conifer encroachment reduced the quality and quantity of bighorn sheep habitat, and sheep expanded their occupied range in response. In this century, both prescribed burning and wildfires, in combination with aggressive weed control efforts, have reversed this trend and are improving habitat conditions, particularly on WDFW-managed lands. However, much of the sheep foraging habitat for the Sinlahekin herd is not under WDFW control. The WADNR and US BLM maintain extensive cattle grazing in the sheep range, and most of the adjacent private land is intensively grazed. These pressures are likely to continue.

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 disease transfer into these bighorn sheep herds, especially *Mycoplasma ovipneumoniae,* the bacterial pathogen associated with bighorn die-offs. WDFW biologists work to encourage holders of small herds of sheep and goats to minimize risk to bighorns whenever possible.

Management Conclusions

Mt. Hull Herd

Reducing the risk of contact between domestics and bighorns, improving range conditions, and 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 and may have led to the current *M. ovi* outbreak. Having these domestic herds *M. ovi* free would reduce the risk of further disease transmission. The proposed range improvements on USFS lands should help 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 Herd

Even with extensive habitat improvements within the Sinlahekin Wildlife Area and the rejuvenating effects of the Okanogan Complex Fire, the herd has not seemed to recover from the declines since 2012. Improved survey accuracy, maintaining separation between bighorn sheep and domestic sheep and goats, and understanding the effects of the Psoroptes mites are the current management priorities.

Bighorn Sheep Status and Trend Report: Region 2

Swakane, Chelan Butte, Manson

EMILY JEFFREYS, District Wildlife Biologist
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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 from British Columbia were reintroduced to the north shore of Lake Chelan to establish the Manson herd. 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 the 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; (4) 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, WDFW estimates 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 over 114 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

GPS Collars

Prior to 2009, herd population data was collected primarily from incidental reports from WDFW personnel, permit hunters, public sightings, and occasionally aerial and ground surveys during the spring and rut periods. All three herds were surveyed in 2009, and uncorrected minimum counts were produced. In March 2009, 12 sheep were outfitted with telemetry collars in the Swakane and Manson herds (18 ewes and six rams). VHF collars were placed on 12 ewes and four rams in Swakane, and GPS collars were placed on six ewes and two rams in Manson. These collars improved our ability to locate sheep during ground and aerial surveys, improving survey data, population estimates, and knowledge of the 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.

Aerial Surveys

Between 2010-2018 the Swakane and Chelan Butte herds were typically surveyed annually during fall ground counts. Ground counts for these 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. In November 2018, the Manson herd was surveyed by helicopter by WDFW personnel, and the Chelan PUD conducted seven surveys by boat over the 2018/19 winter (Pope & Cordell, 2019). In fall 2019, WDFW conducted aerial surveys of the Swakane and Chelan Butte herds. Due to COVID-19 limitations, fall ground surveys were conducted for all three herds in 2020, however, counts were too low in both Chelan and Manson herds to calculate ratios (< 100 animals observed). Inclement weather limited aerial surveys in fall 2021; therefore, aerial surveys were performed again in March 2022. The March 2022 surveys resulted in a minimum population count of 114 sheep in the Chelan Butte herd, 195 in the Swakane herd, and 71 in the Manson herd (Figures 1-3).

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 two in 2016. Additional Swakane harvests occurred in 2009 and 2016 by statewide auction tag winners (Table 1a). Beginning in 2018, the Yakama Nation offered two ram tags for the Swakane herd. All hunters have successfully killed 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 Hwy 97A in 2008. Highway mortalities were significantly reduced with the construction of a wildlife fence along Hwy 97A. A drawing permit for the harvest of one bighorn ram was reinstated for the 2010 hunting season. Currently, the bighorn season in the Swakane runs from September 15-October 10 and two drawing permits for rams in the Swakane herd will be offered in 2022.

Two ram permits per year have been offered in the Manson unit since the hunt began in 2005. Auction tag holders and raffle tag holders regularly harvest rams from the Manson herd (Table 1b). Two drawing permits will be offered for the Manson herd along the north shore of Lake Chelan for 2022.

The Chelan Butte herd was hunted for the first time in 2010, with hunters harvesting mature rams each year since (Table 1c). As aerial and ground surveys of the area confirmed an increasing herd, a second drawing permit for hunters with disabilities was offered in 2015. WDFW is offering four adult ram tags as well as four ewe permits in 2022. Hunters with disabilities will also have the opportunity to draw for five permits: three for bighorn ewes and two for juvenile rams. Raffle tag winners often harvest additional rams from Chelan Butte.

Survival and Mortality

Swakane herd

From 1996 to 2000, the Swakane bighorn population increased slowly. In 2001, the population was estimated at 51 sheep, representing a 46% increase from the 1992-2000 average. The increased count in 2001 resulted after Swakane bands intensified the use of the cliffs and breaks along the Columbia River and Hwy 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 Hwy 97A with increasing frequency. For over 30 years, no bighorn mortalities had been attributed to vehicle collisions. However, in 2002, the number of bighorn sheep killed by vehicles rose steadily, with numerous sheep-vehicle collisions on Hwy 97A. In response to these events, multiple agencies and conservation groups, including the Washington Department of Transportation (WSDOT), State Patrol, WDFW, and the Wenatchee Sportsmen's Association convened a working group to address deer and bighorn sheep vehicle collisions on Hwy 97A. They 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.

Repair costs for fence maintenance can quickly add up. In 2021 WDFW secured matching fund commitments from the Wenatchee Sportsman's Association, Washington Wild Sheep Foundation, and Backcountry Hunters & Anglers to complete delinquent repairs. Prior to being fenced, this stretch of highway was identified as having some of the highest vehicle strikes in the state. Collision rates for bighorn sheep along this stretch dropped significantly since the fence's completion in 2009 until an unusually large number of vehicle-caused mortalities occurred last year. In 2021, at least twenty bighorn sheep were struck by vehicles and killed on Hwy 97A. The vast majority of these sheep mortalities came from the Swakane herd, with only two occurring in the territory of the Chelan Butte herd. Ewes were disproportionately affected, accounting for 18 of 20 known deaths. While concerning, biologists believe this spike in vehicle strikes on 97A represents an anomaly. So far in 2022, only two sheep are known to have been killed on 97A.

Data collected during focused ground surveys has increased minimum counts. From 2011 through 2019, Swakane herd counts increased steadily (Fig. 1). 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 efforts can cause uncertainty in the minimum counts and population estimates. When surveys return a reduced number of observations and no other supporting data suggesting populations decline, the previous year's count may continue to be the best estimate. In 2020, a fall ground census detected a minimum of 163 sheep, with a lamb:ewe ratio of 43:100 (Fig. 1). Aerial surveys were performed in March 2022 and gave a minimum population estimate of 195 sheep, but lamb:ewe ratios could not be calculated due to the late season survey, at which time lambs are difficult to distinguish from young adults.

Manson herd

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 three-year average annual population growth rate of roughly 38%. Locations from telemetry data show that several bands have centralized their core use area westward up lake into steeper, rockier, habitat. This herd consistently has lower lamb production than the other two herds in this District. In 2018, 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, as well as fall boat-based surveys, conducted that same year (Fig. 2). The Chelan PUD recorded a higher minimum count of 96 bighorn sheep during their winter surveys on Lake Chelan in 2017, with an estimated lamb ratio of 15:100 (Pope & Cordell, 2018). Spring 2022 aerial surveys gave a minimum population count of 71 sheep, but lamb:ewe ratios could not be calculated due to the late season survey, at which time lambs are difficult to distinguish from young adults.

Due to its remote location and the complex topography of the Manson herd's core range, it is difficult to conduct an accurate census of this herd. In the spring of 2020, a vehicle collision mortality of a bighorn ewe was found on Highway 153, which is in the Lower Methow Valley. This suggests that animals, possibly from the Manson herd, may be expanding their range and survey efforts need to be expanded to detect possible changes in the core range. To that end, in January 2022, an aerial capture was performed in the Manson herd, and seven bighorn sheep were outfitted with GPS-enabled collars and released onsite. Six ewes and one juvenile ram were collared. One collared ewe died approximately four months later, and a mortality investigation concluded she was killed by a cougar. All other animals collared in January 2022 are still alive, and biologists will attempt to collar an additional four sheep in January 2023. So far, data collected from these collared sheep has not detected any movements beyond the known core herd home range. However, having collared individuals in the herd makes finding sheep easier during aerial surveys and will hopefully allow for the mark-recapture methodology to be used to estimate population size in future years as more collars are deployed.

Chelan Butte herd

In winter 2019, ten bighorn sheep from the Chelan Butte herd were outfitted with GPS-enabled collars and released onsite. Eight adult ewes and two juvenile rams received collars. To date, three of the collared ewes have died: one ewe was predated by a cougar, a hunter-harvested another in the fall of 2020, and the third was found lodged in the debris filter of Rocky Reach Dam on the Columbia River in the spring 2022, cause of death unknown. Five adult ewes remain alive and collared, showing very high local fidelity with little seasonal movement, and both rams that were collared have either slipped their collar or have died.

The Chelan Butte herd has been expanding its range north of Chelan Butte into Deer Mountain and Howard Flats. Observations of bighorns south of Knapp Coulee suggest that expansion is also occurring on that end of the herd's range. A 2020 fall aerial survey detected a minimum of 77 animals in this herd, with a lamb:ewe ratio of 64:100 (Fig. 3). Spring 2022 aerial surveys gave a minimum population count of 114 sheep, but lamb:ewe ratios could not be calculated due to the late season survey and lambs being difficult to distinguish from young adults.

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 from which herd these animals may have originated. In recent years, sheep from the Swakane herd have been detected as far north as the mouth of the Entiat River.

WDFW estimates 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 is regularly seen east and south of Jumpoff Ridge. Residents report a small group of ewes and lambs on Jumpoff Ridge that 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. In September 2021, biologists followed up on a report in the Jumpoff Ridge area of a dead lamb that appeared to have been ill. Subsequent testing of nasal swabs and tissue samples revealed that the lamb had Mycoplasma ovipneumoniae (M. ovi) as well as Epizootic Hemorrhagic Disease (EHD). M. ovi had been suspected in the Quilomene herd for a couple of years, and aerial surveys following the discovery of the infected lamb confirmed M. ovi was widespread throughout the herd.

This infected lamb represents the first detection of M. ovi in District 7. While the Swakane, Chelan Butte, and Manson herds are thought to currently remain free of M. Ovi, this highly transmissible disease poses a constant threat. In May 2022, a biologist observed several bighorn sheep off Lower Sunnyslope Road, south of Hwy 2, which is the farthest south members of the Swakane herd have been reported. This is still quite a distance from Jumpoff Ridge but is indicative of our herds' potential for coming into contact with infected sheep, whether domestic or bighorn.

Habitat

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. Habitat conditions for these two herds are driven by historic land uses, the current fire regime, and the success of active habitat restoration. Fires can be beneficial to bighorn sheep by reducing conifer encroachment and increasing the forage quality of perennial grasses and forbs. Dependent on the pre-fire vegetation conditions, fire severity, and post-fire precipitation regimes, these burn scars have the potential for passive recovery and providing more palatable forage during the early seral stage of vegetation recovery. Bighorns have been observed utilizing fall "green-up" within burned areas immediately following a fire. Lower elevation arid grasslands and shrub steppe communities are most at-risk as the fire return interval has shortened and human-caused fires are increasing.

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. As a result, vegetation communities are being altered by reduction of the shrub component and increased invasive annual grasses and weeds. 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. The Red Apple and Swakane fires of 2021 burned part of the Swakane herd's range, and 1,200 acres of the Chelan Butte herd's range burned in the 2022 Stayman Flats fire.

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 eight 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 Manson herd on the north shore of Lake Chelan occupies a somewhat different habitat, 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, 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. The most recent fire within the Manson herd range was the 2017 Uno Peak Fire, which burned approximately 9,000 acres of higher-elevation timbered habitats. Survey efforts have not included this area post-fire, so it is unknown if sheep have responded to habitat changes by utilizing new areas within the recovery zone.

The Manson herd occurs almost entirely on land managed by USFS, with a few private lakefront properties at the southeastern end of its range. The herd's 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 Swakane herd range along the Columbia River breaks. Prior to the fence construction, ewe bands regularly moved to the river to access native riparian and ornamental forage. The completion of the Hwy 97A fence excluded sheep from a small amount of habitat, as they always spent most of their time in habitats west of the highway. While sheep likely use developed springs, their presence is not thought to be critical to the herd. Telemetry data indicate that sheep did not alter their patterns of seasonal habitat use in response to the construction of the wildlife fence.

Maintaining habitat connectivity at lower elevations is a priority for managing Chelan County's bighorn sheep herds. Chelan County is growing rapidly, with a 9% population increase between 2020 and 2022. Most development occurs below 2,000 ft. on slopes less than 20%, but newly constructed homes continue to encroach on the Swakane and Chelan Butte herds' ranges. 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

Reports have been received in recent years from orchardists adjacent to the Swakane and Chelan Butte units about the presence of bighorns in their orchards. They have expressed concerns of damage to young trees, but no claims for damage have yet been filed. Observations indicate that the sheep are feeding mainly on grass within the irrigated orchards, but occasional browse on new plantings may cause damage. Some orchardists take proactive measures to exclude bighorn sheep by erecting deer fences, and old fences on the Chelan Butte Wildlife Area have been 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. 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 & Longshore, 2017; Wiedmann & Bleich, 2014). Discussions are underway 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. These herds do not make long-distance seasonal migrations, and 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 reasonable to expect to see 50 to 100 bighorns during the peak of the breeding season. The lack of safe pullouts along Hwy 97A near the fall sheep congregation can sometimes create traffic hazards.

In 2019, WSDOT expressed concern over bighorn sheep use of cliff faces above Hwy 97A to the south of Knapp Tunnel. It was reported that bighorn sheep were causing dangerous rock fall onto the highway, though the extent of rock fall caused by sheep, versus natural cleaving, was unknown. In January 2020, WSDOT submitted a proposal to conduct a slope study of the area using drones. This was approved, with conditions to avoid wildlife disturbance. However, due to significant rock fall events in the spring of 2020, WSDOT applied for an emergency permit to conduct hillside stabilization and install netting as a barrier to falling rock. Knapp Tunnel is a bored tunnel with a natural rock and vegetation surface which allows sheep to cross over the highway. Small groups of bighorns were detected just south of Knapp Tunnel during 2019 fall aerial surveys.

Population Augmentation

There have been no bighorn sheep population augmentations in Chelan County since 2004, and there are no plans to translocate bighorns in the immediate future. In winter 2019, WDFW captured 30 bighorn sheep from the Chelan Butte herd. All animals were tested for pathogens, including *Mycoplasma ovipneumoniae,* for which they tested negative. Twenty animals were translocated to the Stansbury Mountains in Utah, to augment a newly re-established herd.

Research

No formal research is currently being conducted on any bighorn sheep herds in Chelan County.

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 six 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. In 2021, WDFW lethally removed a young ram from the Chelan Butte herd in the Apple Acres area after the ram had been observed grazing in a domestic sheep pasture.

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; 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. 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. USFS is preparing an Environmental Impact Statement for domestic sheep grazing within the bighorn sheep range. In the interim, however, as the population of the Swakane herd grows, management actions will need to be taken to minimize the risk of contact with domestic sheep, through ewe harvest and translocation.

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. In 2021 WDFW initiated a cooperative agreement with a private landowner to extend a section of the Hwy 97A fence that will exclude bighorn sheep from entering pasture containing domestic goats. These domestic goats were tested for *M. ovipneumonia* in 2014 and again in 2021; both times results were negative. WDFW intends to continue disease surveillance in this flock in cooperation with the landowners. In 2022, WDFW, in cooperation with WSF, began constructing a fence around a domestic goat operation in Oklahoma Gulch to reduce the risk of disease transmission to the Chelan Butte herd.

The Swakane and Chelan Butte bighorn population are highly accessible for viewing during the winter months. Viewing opportunities, particularly large adult rams, are highly valued by the public. A long-term objective of the Chelan Wildlife Area plan is to create safe viewing opportunities for the public. As the population of Chelan County grows, recreational use on public lands increases. WDFW will have to engage in land use planning at federal and state effectively, and local levels to ensure a balanced approach and minimize impacts on bighorn sheep populations.

The minimum population objective for the Manson herd on the north shore of Lake Chelan is conservative, based on the low potential for conflicts, USFS management emphasis on 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, poor detectability in rugged terrain, or from a yet undiscovered source of additional mortality. By collaring several sheep in 2022 and continuing these collaring and monitoring efforts in the coming years, WDFW aims to learn more about the movements of the Manson herd and identify factors that may be contributing to the lack of growth in this population.

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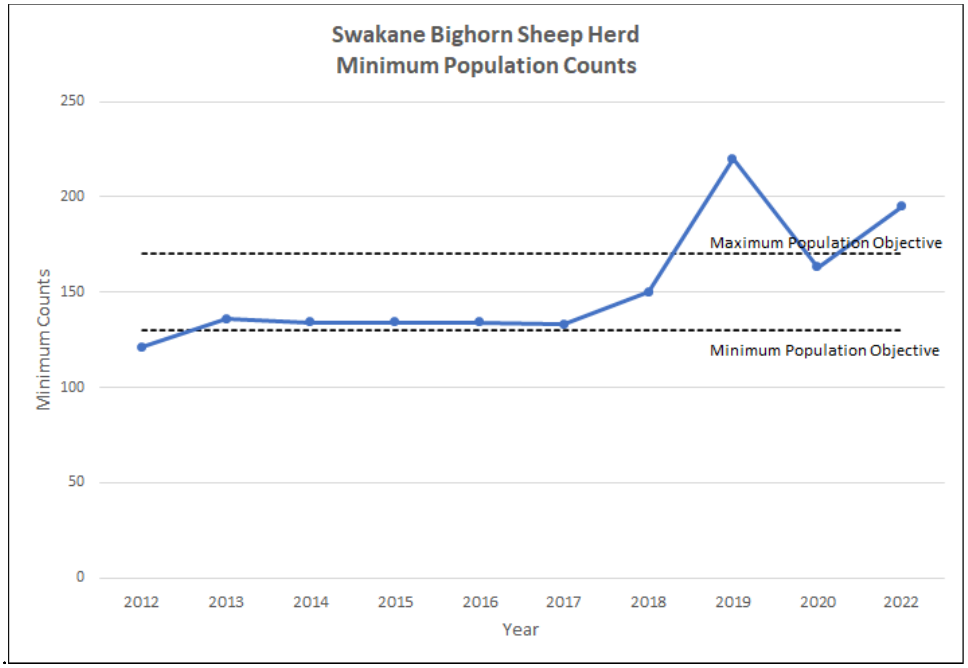

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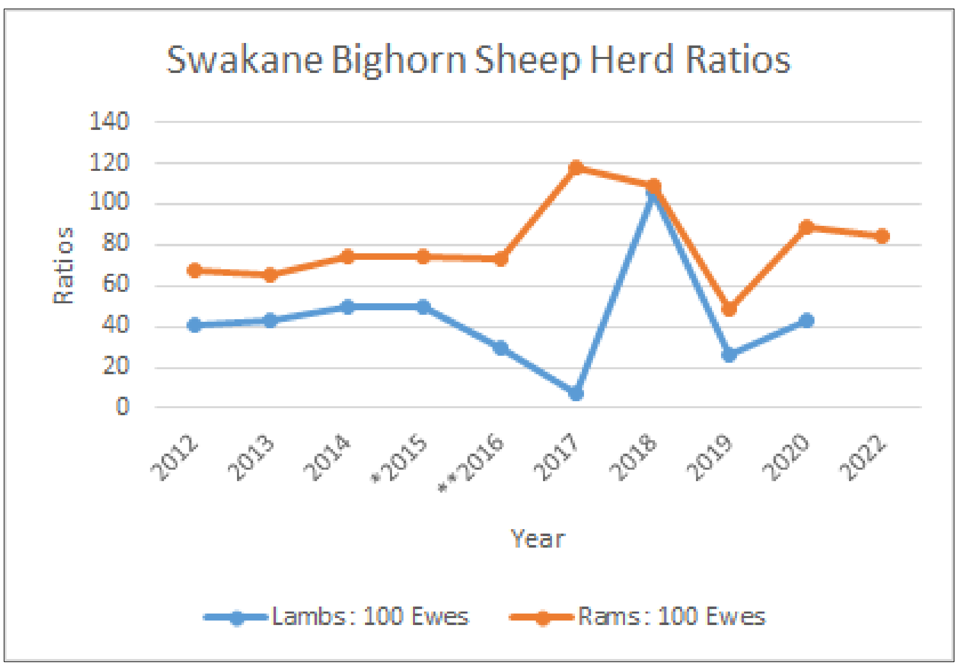
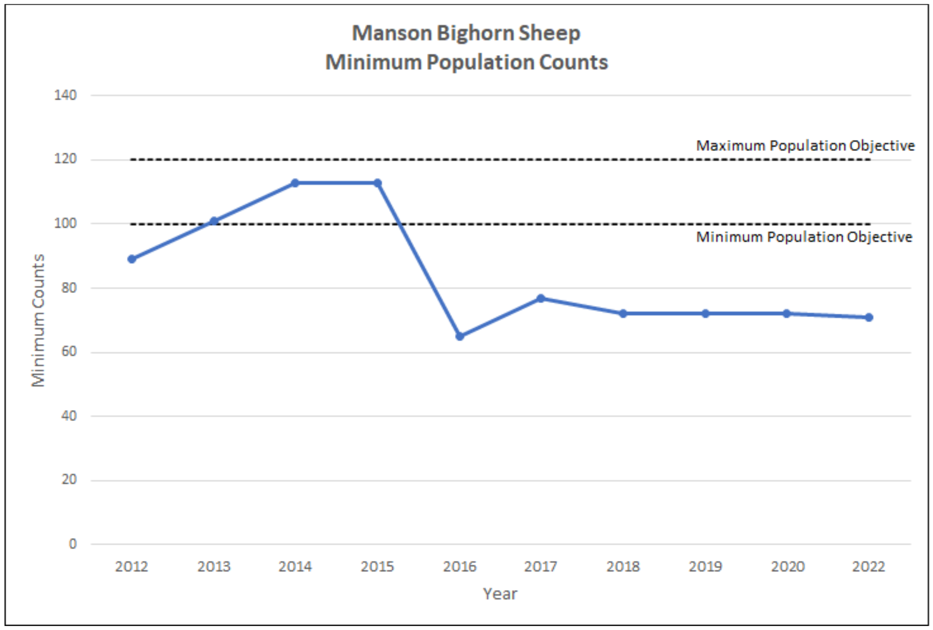


b)

Figure 1: (a) Minimum population counts of the Swakane herd 2012-2022, dashed lines represent short-term population objectives from the 2015 Game Management Plan. (b) Observed ram:100 ewe ratios (orange line) and lamb:100 ewe ratios (blue line).

a)



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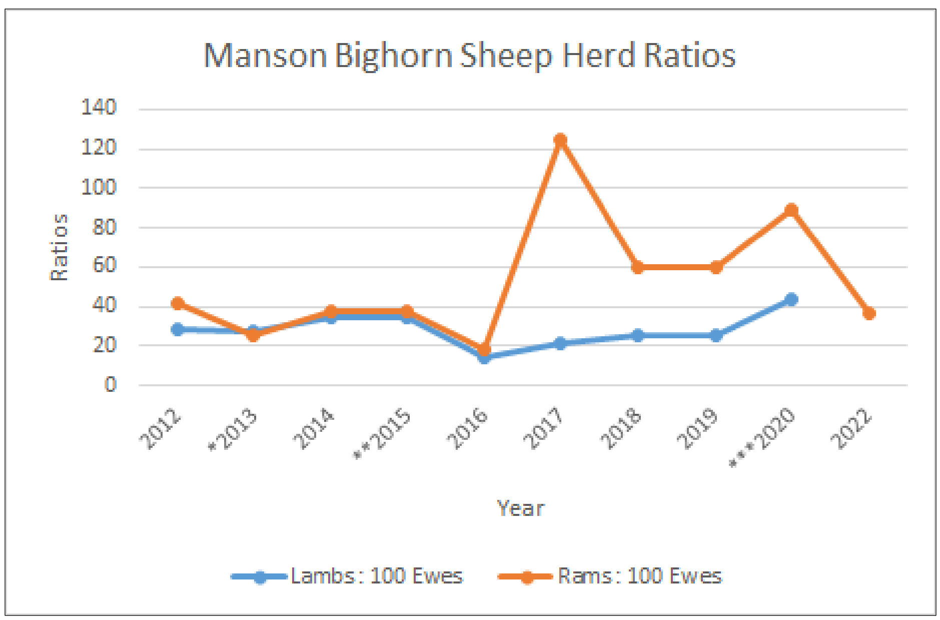
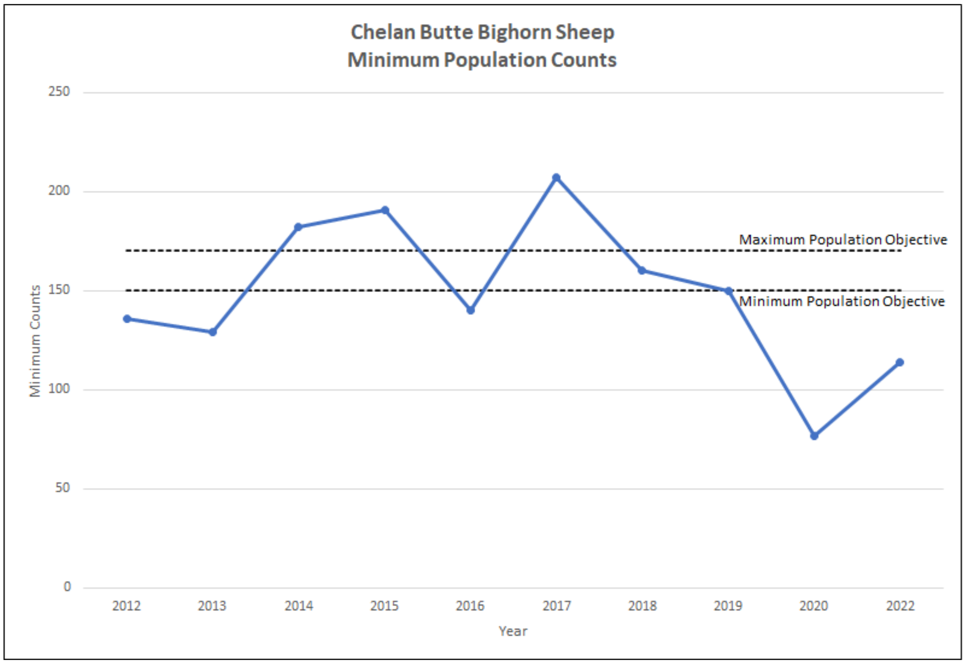


Figure 2: (a) Minimum population counts of the Manson herd 2012-2022, dashed lines represent short-term population objectives from the 2015 Game Management Plan. (b) Observed ram:100 ewe ratios (orange line) and lamb:100 ewe ratios (blue line).

a)


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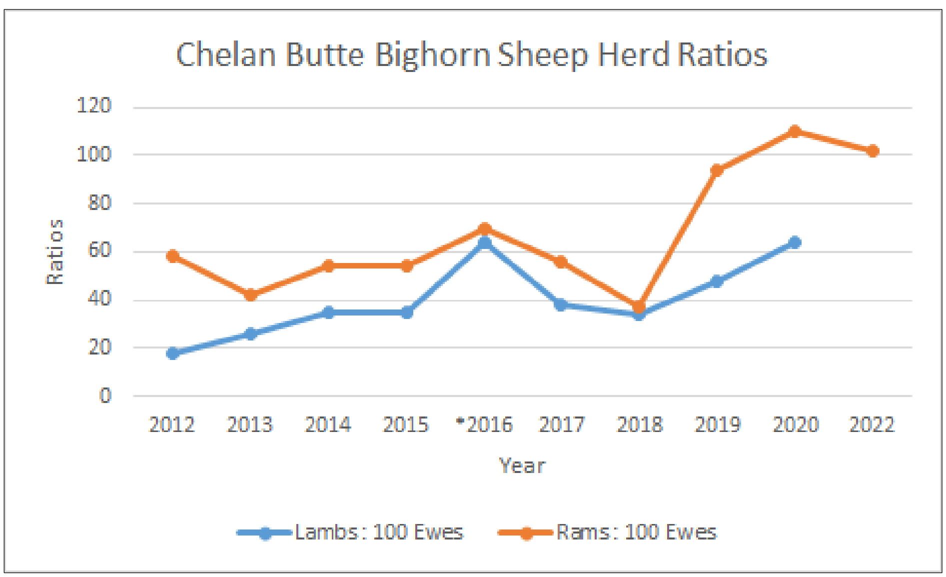

Figure 3: (a) Minimum population counts of the Chelan Butte herd 2012-2022, dashed lines represent short-term population objectives from the 2015 Game Management Plan. (b) Observed ram:100 ewe ratios (orange line) and lamb:100 ewe ratios (blue line).

Table 1A: 10 Yr. Summary of Ram Harvest: Swakane

Year	Permits	Harvest	Comments
2012	1	1	
2013	1	1	
2014	1	1	
2015	1	1	
2016	3	3	Includes harvest by auction tag holder
2017	2	2	
2018*	2	3	Tribal harvest unknown
2019*	2	3	Tribal harvest unknown
2020	2	2	
2021	2	2	
Total	**17**	**19**	

Table 1B. 10-year Summary of Ram Harvest: Manson

Year	Permits	Harvest	Comments
2012	2	3	Includes additional auction/raffle tag harvest
2013	2	3	Includes additional auction/raffle tag harvest
2014	2	2	
2015	2	2	
2016	2	2	
2017	2	2	
2018	2	2	
2019	2	2	
2020	2	2	
2021	2	1	
Total	**20**	**21**	

Table 1C. 10-year Summary of Ram and Ewe Harvest: Chelan Butte

Year	Permits	Disabled Hunt Permits	Harvest	Comments
2012	1	–	1	
2013	1	–	1	
2014	1	–	1	
2015	4	3	5	1st ewe tag offered
2016	6	4	7	Includes additional auction/raffle tag harvest
2017	6	4	5	
2018	13	5	15	Includes additional auction/raffle tag harvest
2019	13	5	12	
2020	13	5	11	Includes additional raffle harvest
2021	13		12	
Total	**71**	**26**	**70**	

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

The Quilomene herd was surveyed via helicopter in October and November 2020. The Yakima Canyon Herd was surveyed via ground in July 2021. The Cleman herd was surveyed from the ground at the feed site in December 2021 (Tables 2-5).

Hunting Seasons and Recreational Harvest

Cleman Mountain, Umtanum/Selah Butte, and Quilomene are currently permitted for ram harvest. Ewe permits have been issued for Cleman since 2016, and Umtanum/Selah Butte was permitted for ewes or juvenile rams since 2019. 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 the public/WDFW enforcement often encounters their hunters. When YN harvest is available to WDFW, it is included in Table 1.

In 2021, WDFW issued 16 herd-specific ram permits, one raffle (any herd), 19 ewe permits, and 44 juvenile ram or ewe permits. A total of 16 adult rams and 36 juvenile rams/ewes were known to be harvested (Table 1).

Herd History and Status

Bighorn sheep were native to Region 3 but had been eliminated by overhunting and disease by the early 1900s. All existing populations are the result of reintroductions.

The Quilomene reintroduction was the first in the region (the early 1960s). 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, and 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 low, and the population was below objective. The herd was augmented with eight ewes, seven lambs, and six rams obtained from the Cleman's Mountain herd in January 2017. The augmentation and recent recruitment/survival boosted Quilomene sheep to the short-term objective.

A domestic ewe was spotted with Quilomene sheep in September 2020. The domestic tested positive for *Mycoplasma ovipneumoniae (M.ovi*). Nine rams and three ewes were lethally removed from the immediate area for testing. None tested positive for *M. ovi.* Three aerial surveys were done to look for sheep showing signs of pneumonia. All Quilomene bighorn looked healthy. It appeared *M. ovi.* was not transferred from the domestic to the bighorns in 2020. In 2021, sick bighorns were reported at the north end of the herd. A dead lamb was sampled and found to have pnuemonia due to *M. ovi.* In summer 2022, sick lambs were reported at the south end of the herd. One dying lamb was sampled and also found to have *M. ovi* related pneumonia.

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).

Almost 200 animals have been relocated from Cleman to establish/augment numerous herds since 2001. Recreational harvest has also been the highest in the state here. The Cleman Mountain herd continues to produce a large number of lambs and continues to be above objective. The Cleman herd was known to be at high risk of contracting *M. ovi* due to the proximity to USFS domestic sheep grazing leases. In fall 2020, WDFW detected *M. ovi* in several bighorns from the Cleman herd and the department received subsequent reports of coughing or dead bighorn within the herd area. Five additional ram permits were issued in expectation of a die-off. The die-off was relatively minor and concentrated on rams and lambs. Only 2 lambs are known to have survived 2021.

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 (i.e., 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 to over 300 animals after 2002 was largely due to the establishment of the Roza Dam sub-herd and 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. Bacterial pneumonia jumped east of the river (Selah Butte) in summer 2010, but no significant mortality was noted. By August 2010, low lamb survival was apparent on both sides of the river.

Lamb and adult survival were 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 *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 2009. Bernatowicz et al. (2016) provides a full accounting of the experience with pneumonia in the Umtanum/Selah herds. 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 are 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 and sporadic. Most lambs have been male. This anomaly was also documented during culling in early 2010 when 82% of fetuses were male.

Low recruitment and few females have resulted in a declining and aging reproductive segment of the population. A plan was adopted to reduce the population through harvest to around 100, then test and cull" any animals shedding *M. ovi*. In February 2021, the first phase of "test-cull" was implemented. Eighty bighorns were captured and tested. Eight tested positive for *M. ovi* and seven were subsequently lethally removed. The one animal not removed was a juvenile ram that was incidentally caught during the targeted capture of adults. Of the seven animals removed, six were re-tested for *M. ovi*. Only one was still positive, and two indeterminate. Testing of roughly 180 animals to date indicates that about 10% might be "shedders" on a given day. However, clearing M. ovi from the population will be nearly impossible if most are intermittent shedders. Data collected from the ground in July indicated low lamb recruitment in most sub-herds. A further test and cull operation was planned for winter 2021-2022 until coughing rams were observed in September 2021. Sampling found a new strain of *M. ovi* had entered the population. No significant mortality was seen from the new strain, but lamb survival is not known.

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 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 sheep. The current Game Management Plan calls for re-establishing the Tieton Herd if the risk from nearby domestic grazing allotments can be eliminated.

Habitat

Forage resources vary annually with moisture and fire. A significant portion of the north Quilomene range burned in 2013. A large fire burned portions of both the Yakima Canyon and Clemans in 2020. another fire burned portions of Quilomene in 2022. 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. Post-2020 fire conditions were extremely dry, which likely favored grasses and lower diversity.

Population Augmentation

The Quilomene herd received 21 sheep from the Cleman's Mountain herd in January 2017. This augmentation was more driven by opportunity than necessity. The Cleman's herd had 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. That augmentation did have a positive effect.

No habitat enhancement projects have been funded for bighorn sheep in the region. In general, bighorn habitat is difficult to manipulate, and the 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 the 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 was infected in 2009 and again in 2021. Clemans was infected in 2020. Quilomene bighorns have had frequent contact with domestics in the last five years, so the documented lamb mortality and M. ovi were not surprising in 2021. Data from across the range of Bighorns in North America indicate that few herds recover on their own. Removing an entire herd and starting over has social and political challenges.

Disease outbreaks are expected because domestic sheep and goats have been documented near bighorns in every herd in the Region. Completely eliminating risk of contact between bighorns and domestics is unlikely. Efforts are needed to reduce the risk as well as develop viable management options once *M.* o*vi* enters a population.

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Table 1. Summary of bighorn sheep harvest in Region 3 since 2008.

Area	Year	Permits	Harvest	Comments
Cleman Mountain	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	
	2019	4 ram, 20 ewe	9 ram, 15 ewe	Harvest includes raffle hunter, tribal
	2020	10 ram, 21ewe	15 ram, 21 ewe	Harvest includes raffle hunter, tribal
	2021	3 ram, 19 ewe	3 ram, 15 ewe	
Umtanum/Selah Butte	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
	2019	8 ram, 46 juv. ram/ewe	39 ram, 14 ewe	Harvest includes tribal
	2020	6 ad ram, 8 juv. ram, 30 ewe	13 ram, 21 ewe	Harvest includes raffle hunter, tribal
	2021	8 ram, 44 juv. ram/ewe	8 ad. rams, 36 ewe/juv. ram	
Quilomene	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
	2019	5	5	
	2020	6	5	Harvest includes tribal
	2021	5	5	

Table 2. Quilomene Population Composition.

Year	Lambs	Ewes	Total Rams	Adult Rams	Total Count	Estimated Population	Short-term Objective
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
2019	No	Survey					
2020	29	116	71	36	216	220	
2021					201	210	

Table 3. Cleman Mt. Population Composition.

Year	Lambs	Ewes	Total Rams	Adult Rams	Total Count	Estimated	Short-term Objective
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
2019							
2020	22	131	37	12	190	210	170-220
2021	2	126	22	n/a	150	175	100

Table 4. Umtanum/Selah Butte Population Composition.

Year	Lambs	Ewes	Total Rams	Adult Rams	Total Count	Estimated	Short-term Objective
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
2019	14	94	26	23	134	150	100
2020	14	64	41	32	119	130	100
2021	21	75	33	21	129	140	100

* 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*) 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). However, the literature reports a bull moose that was taken by hunting on the Colville Indian Reservation in 1929 (Scheffer & Dalquest, 1944). In the decades since, moose have increased both in numbers and distribution. They are now common in northeastern 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 produced 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 winter 2015/16. This survey was intended to provide a baseline population estimate from which future trends will be assessed. A full report appears as Oyster et al. (2018).

District-level surveys for composition were reinitiated in the winter of 2018/19. Three days of flights in District 2 resulted in the observation of 101 moose (45 cows, 39 bulls, and 17 calves). No surveys were completed in 2019/20 because mild conditions persisted throughout the winter resulting in inadequate survey conditions (i.e., lack of snow cover). Aerial surveys did not occur in 2020/21 due to poor survey conditions as well as COVID-19 restrictions. One flight was completed in District 1 in 2021/22, but overall survey conditions were poor again this winter.

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; auction and raffle hunts begin September 1st. The “any moose” permit category was changed into an “antlered bull moose only” permit 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) has steadily increased since the late 1990s (Fig. 1), peaking in 2016. Since then, antlerless permit numbers have been reduced due to concerns about population declines.

In 2021, there were a total of 135 moose permits available. Of these, 129 permit holders reported hunting, with 106 moose reported harvested. The following were permit types available in 2021, followed in parathesis by the number offered / minimum number harvested; this is minimum harvest because not all permittees report. “Antlered bull” moose (105/84), antlerless-only (24/17), youth antlerless (1/1), 65-and-over antlerless (3/3), disabled antlerless (2/1), statewide raffle (2/2), Northeast Washington multi-species raffle (1/0), and statewide auction (1/1). Of the 106 moose reported harvested 85 were male, and 21 were female. For information on hunting moose in Washington (e.g., number of permits, success rates, hunt units, access, etc.), please see the Hunting Prospects for Districts 1 and 2 (Hunting Prospects).

Habitat

Moose prefer 10-20-year-old clearcuts, 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 tends to produce dense stands of willow, serviceberry, ceanothus, and other shrubs that are preferred browse. However, private industrial forests have recently 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 the dissemination of literature and discussion on living with wildlife, to moose in dangerous situations requiring immobilization and translocation or euthanasia. The number of moose incidents per year has been as high as 87 in 2001 and as low as 16 in 2009.

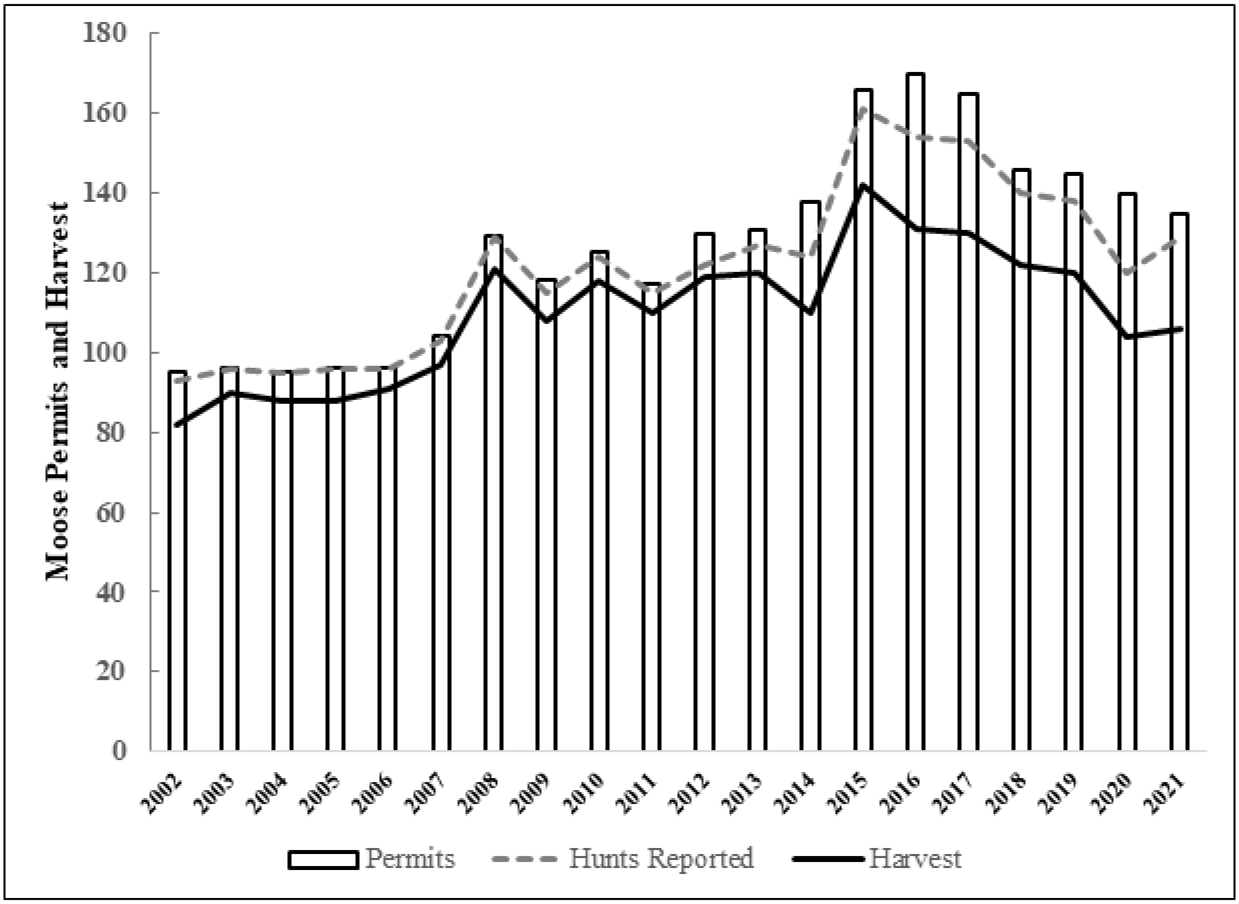

Figure 1. Moose permit numbers (open bars, not including Master Hunter and Hunter Educator Incentive moose permits), hunts reported (dashed line) and harvest reported (solid line) for moose in Washington, 2002-2021.

Research

With financial and logistic support from WDFW, the University of Montana (UM) took the lead in understanding factors controlling the demographic parameters of moose in two study areas north of Spokane. Seventy-four cow moose were fitted with radio collars in December 2013, 2014, and 2016. Results from the study were published in two articles in Alces in 2021 (Harris et al., 2021; Cook et al., 2021). In general, the moose populations in both study areas were found to be declining due to both the top-down effects of predation and the bottom-up effects of nutrition.

Management Concerns

Fire suppression, reduced timber harvest, herbicide treatment of broadleaf shrubs in regenerating forests, 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 biologists expect to see a tempering of the population 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. The direct energetic effects include when temperatures exceed their thermo-neutral tolerances (moose are adapted to cold climates and become heat stressed, both in summer and winter) 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 United States. A total of 126 carcasses were inspected, of which we were able to determine the 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 in 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 shows promise, recent surveys have been limited (i.e., poor survey conditions, Covid-19 restrictions), and tracking moose population trends long-term over large areas will likely always be approximate and prone to time-lags. Moose abundance in their core in northeastern Washington has declined, possibly due to moose populations exceeding the capacity of available forage and as other natural factors (e.g., predators, parasites, climate change) respond to their abundance. Moose may continue to increase outside of their base in northeastern Washington, and it is possible that hunting opportunities can be developed in other parts of the state in the future.

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Cougar

Cougar Status and Trend Report

STATEWIDE

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Introduction

The cougar (*Puma concolor*) is a native species in Washington. It occupies all forested areas and parts of the Columbia basin where vegetation provides adequate cover (Figure 1); they typically do not occur on the island archipelago of Puget Sound. Cougars are predominantly active at dawn and dusk but can be active at all times of the day, so it is not uncommon for humans to see cougars moving through the natural landscape. Generally solitary by nature, cougars typically only come together in family groups (females with dependent young) to mate and when males challenge each other for territory. Cougars are a density-dependent species, meaning the number of resident cougars on the landscape is limited by the amount of available space and prey. As one of Washington's apex carnivores, cougars help to maintain ecosystem health and diversity. Their diet contributes to healthy ecosystems by providing food for other scavenging mammalian and avian species, including insects which deposit nutrients and enrich soils for future plant growth.

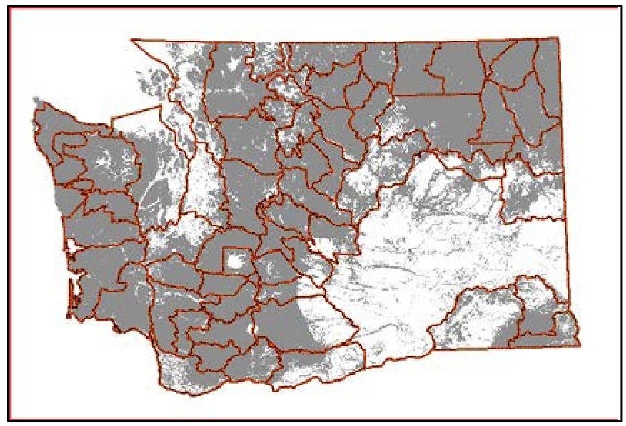

Figure 1. Fifty population management unit boundaries in Washington, 2022.

Management Guidelines and Objectives

For management purposes, the state is divided into fifty population management units (PMUs) (Figure 1). Like many other wildlife agencies in western North America, Washington's hunt structure includes harvest guidelines that are applied to specific areas with identifiable boundaries. Most PMUs are approximately 1,750 km^2 in size, except for the PMU that encompasses the Columbia Basin, and 45 of the 50 PMUs have harvest guidelines. Harvest guideline considerations begin January 1 (late season), and 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 harvest applies towards these closures to achieve the cougar management objectives as outlined in WDFW's Game Management Plan (WDFW, 2015).

The benefits of this cougar management structure include:

- provides ample recreational harvest opportunity
- harvest is fair and equitable across the landscape
- older-aged animals on the landscape, thus a better-quality hunt
- smaller PMUs reduce large area closures increasing hunter opportunity and harvest potential
- maintains the integrity of the cougar social structure and ecosystem function
- inexpensive to implement
- scientific, transparent, and defensible process
- satisfies agency and multi-stakeholder interests

Population Surveys

Cougars are among the most challenging species to obtain population estimates. Nonetheless, population estimates are no longer unknown as WDFW has funded decades of long-term cougar research (1998-2020) in collaboration with universities to generate 39 annual density estimates from nine research areas within Washington (Beausoleil et al., 2021; Beausoleil et al., 2016, Figure 2).

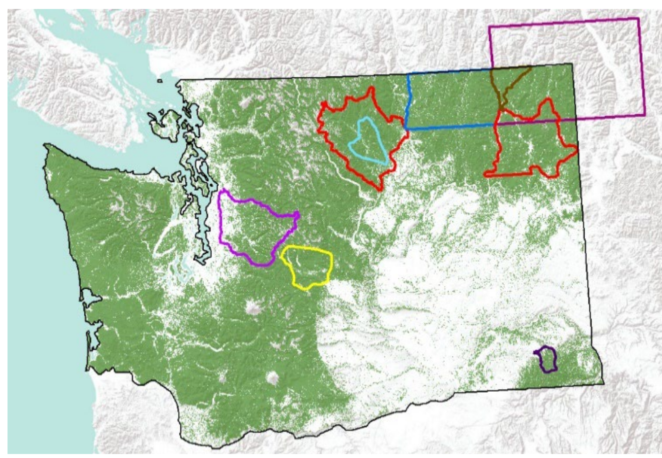

Figure 2. Cougar research areas in Washington, where 39 density estimates were derived, 1998-2021. Areas in red have not yet been completed. Green indicates cougar habitat.

Tribal entities have conducted similar research on the Olympic Peninsula and the south Cascades, where similar densities have been reported. Cougar density estimates are primarily derived using one of three estimation techniques: 1) capture-collar using GPS data to define proportional contribution to density within a defined study area, 2) spatially explicit capture-recapture, and 3) population abundance divided by a generalized study area.

Estimates in Washington have been derived using all three of these techniques (Table 1). Most of this research has been conducted in northeastern Washington but also includes the southeast, central, and western portions of the state. Biologists focused research estimates on independent-aged animals (≥ 18 months) to calculate densities and subsequently develop harvest guidelines. Kittens were not included in independent-aged density estimates or harvest guidelines because they are protected by law, and if incorporated into estimates may by default mask an inflated harvest rate on independent-aged cougars and increase management risk.

All density variations observed throughout Washington were used to estimate a distribution of likely population sizes and the probability of achieving management objectives in each PMU given various harvest levels (Beausoleil et al., 2021). This work was strengthened by Murphy et al. (2022), who demonstrated that when model-generated densities were corrected for biases such as the inclusion of dependent young or not accounting for spatial distribution of cougars, the range of cougar densities observed in Washington was consistent with other densities documented throughout the species' range. Currently, the independent-aged statewide cougar population is estimated at 2,300 cougars.

Table 1. Independent-aged (>18 months) cougar density estimates from six counties in Washington, Washington Department of Fish and Wildlife 2021.

Study Area County	Years Conducted	Average Independent-Aged Density /100km^2 (>18 months)	Source
Okanogan	2003-2013	1.55	Beausoleil et al. 2021
Columbia	2009-2013	2.79	Beausoleil et al. 2021
King	2008-2016	2.34	Beausoleil et al. 2021
Ferry	2003-2011	1.79	Beausoleil et al. 2016[a]
Kittitas	2002-2006	2.37	Cooley et al. 2009[b]
Stevens	2002-2006	1.96	Cooley et al. 2009[b]

[a] Estimate was for >12 months so modified to include only ≥18 months of age for consistency

[b] Estimate was for >24 months so modified in Beausoleil et al. 2021 to include only ≥18 months of age for consistency

Hunting Seasons and Recreational Harvest

The cougar hunting season is currently 242 days and occurs statewide in all 50 PMUs. Approximately 54,500 cougar hunting licenses are sold annually (Table 2). License sales have gradually increased over the last ten years, with the highest ever reported cougar license sales occurring in the 2012-22 season.

Tribal entities have their own hunting seasons and do not fall under WDFW management authority; thus, on-reservation and off-reservation harvest by hunters licensed under Tribal governments in WDFW-managed GMUs are unknown with limited exceptions (e.g., Northwest Indian Fisheries Commission).

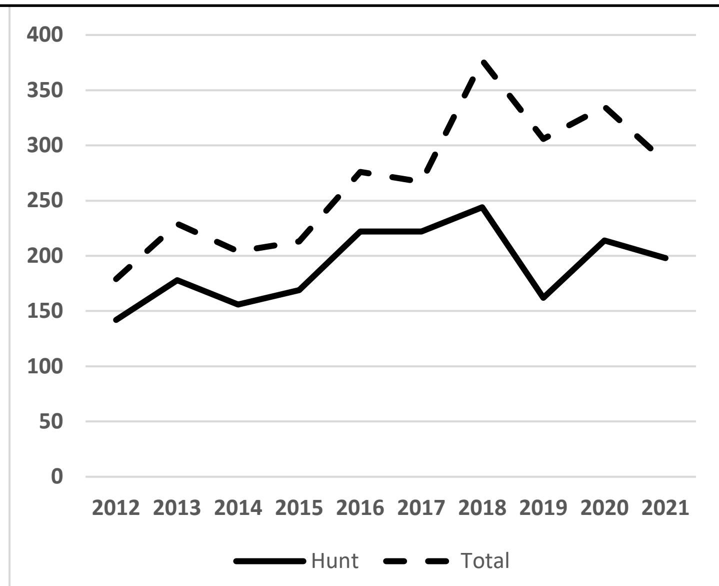

Figure 3. Cougar hunter harvest and total mortality from the 2011-12 through the 2021-22 seasons, Washington Department of Fish and Wildlife. Tribal harvest and natural mortality are unknown and not included.

Washington implements an early and a late general cougar season. During the early season (September 1 – December 31), harvest guidelines do not apply; even if harvest exceeds the guideline, PMUs will not close until December 31. In the late season (January 1 – April 30), harvest guidelines apply, with only hunter harvest counting towards that guideline. Since 2004, the agency has provided hunters with updates on the status of open and closed PMUs via a toll-free hotline and by checking the agency's website.

Over the past five years, an average of 74% of PMUs remained open to hunters through April 30. Closures occur at the PMU level, resulting in less impact on hunter opportunity. In 2020, the Washington Fish and Wildlife Commission voted to modify the harvest guidelines and hunting structure. The modified harvest guidelines were intended to extend the cougar season in select areas by increasing harvest and reducing the age classes that count towards PMU closure by: (a) using prior harvest levels where guidelines had previously been exceeded to set the guideline.; and (b) counting only adult cougars (>24 months old) rather than independent-aged cougars (>18 months) when considering PMU closure statewide. We will evaluate if this approach changes harvest levels and harvest demographics.

Table 2. Cougar licenses sold 2011-12 through 2021-22 seasons Washington Department of Fish and Wildlife.

	License Year										
	2011-2012	**2012-2013**	**2013-2014**	**2014-2015**	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**	**2020-2021**	**2021-2022**
Licenses	54,321	49,118	50,878	50,874	53,196	54,636	55,636	56,785	57,421	46,391	69,632

Over the past 20 years, hunter-harvest and non-hunt mortality (agency removals, poaching, vehicle collisions, etc.) have increased. The increase in statewide hunter-harvest was intentional, the 2013 hunt structure created smaller hunt units intended to disperse hunters that stayed open longer which created more opportunity for sustainable harvest. The most recent five-year average (2017-18 through 2021-22 seasons) cougar harvest was 208 animals annually, and all mortality (hunting and non-hunt mortality) was 314 animals, an increase of 20% and 43%, respectively, compared to the previous 5-year average; 2012-13 through 2016-17 harvest was 173 and 220 for total mortality, respectively. The current overall 10-year average (2012-13 through 2020-21) cougar hunter harvest is 191, annually and total mortality is 267 animals annually, an increase of 10% and 21%, respectively. The previous 10-year average hunter harvest was 158 animals and total mortality was 194 animals.

Washington has a mandatory inspection, sealing, and reporting program for cougar hunters. Hunters are required to present the hide and skull (with proof of sex attached) to agency staff for sealing within five days of the harvest. All harvest and biological data are recorded by staff electronically using ArcGIS Survey123 applications; thus, information is available immediately. Data collected from mortalities include hunter information (when applicable), weapon type, hunter effort, kill location within a GMU, sex, and age class. A tooth is pulled for aging, and DNA is collected for genetic analysis.

Survival and Mortality

Hunting is the main source of mortality for cougar populations across Washington. Hunting mortality averages 68% of the known human-caused mortalities over the most recent 5-years, compared to 78% for the previous 5-year average and 72% for the previous 10-year average. Other human-caused mortalities include agency removals, which have increased in recent years, as well as landowner kills, vehicle collisions, and poaching (Figure 3).

Percent female harvest currently averages approximately 54% annually. Martorello and Beausoleil (2003) first described this change with an analysis demonstrating that female harvest went from an average of 42%(1990-91 through 1995-96 seasons) to 59% (1996-97 through 2000-01 seasons). This was an expected change as we went from a more selective harvest method (hound hunting) to a less selective method (boot hunting). Without hounds, hunters are harvesting animals as they encounter them and female cougars have smaller home ranges, thus we expect a higher female harvest without the selectivity that hound hunting provides.

Ages of cougar mortalities are derived by collecting a tooth from hunter kills during mandatory inspection and sealing, and similarly for other known mortalities. After cataloging the associated field data and assigning a unique identifier to each tooth, teeth are sent to an independent laboratory where each tooth is sectioned, stained, and examined under a microscope. Cementum is deposited as layers on the roots of teeth each year, and the ages are determined by simply counting annual layers on each sectioned tooth, much like counting the "rings" on a cut tree. The median ages of hunter-harvested cougars are presented in Figure 4.

Habitat

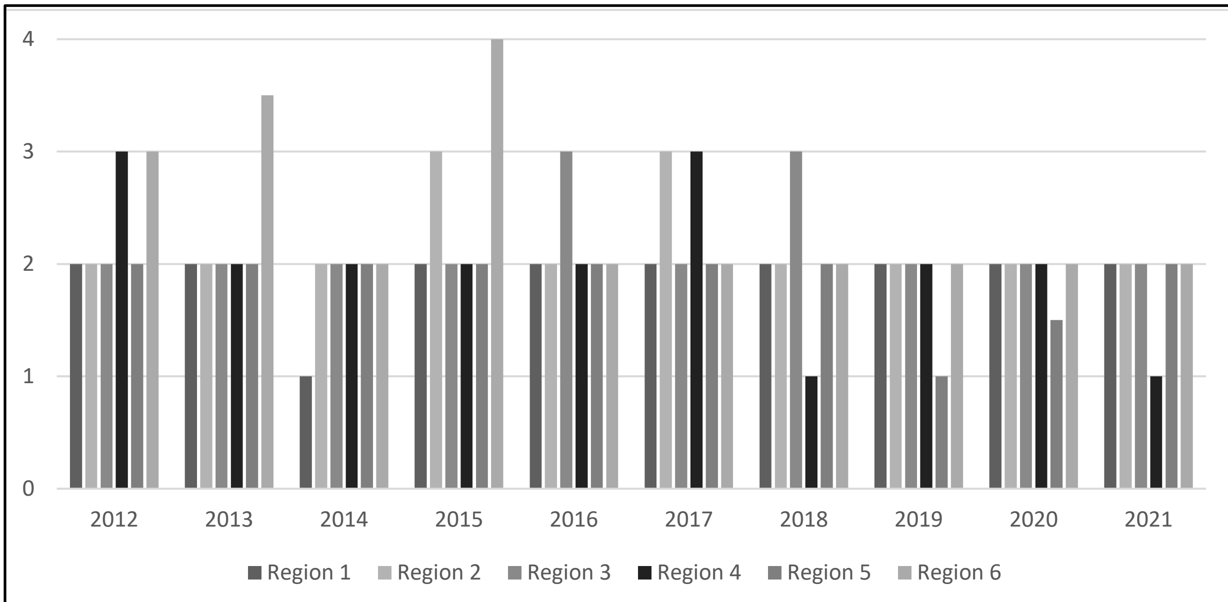

Figure 4. Median ages of cougar mortality by Region, annually, 2012-13 through the 2021-22 seasons. Washington Department of Fish and Wildlife.

Cougar habitat was reassessed in 2018 using research data on habitat use, and the current habitat estimate encompasses approximately 104,500 km^2 throughout Washington; 91,000 km^2 of which WDFW manages for hunting opportunity (Figure 1). The National Parks and tribal lands were included in this assessment but did not fall under WDFW's management authority. Washington is the smallest of the western states and has the least available cougar habitat. Idaho has approximately 99% more habitat than Washington. While independent-aged density is similar to other jurisdictions, there is 84% more habitat in Montana and 61% more habitat in Oregon; this is a primary reason why these jurisdictions have more cougars. In Washington, forested corridors facilitate cougar movements, maintaining landscape connectivity and preserving gene flow (Warren et al., 2016). As human populations expand, preserving these connective corridors may be an essential management need in the future.

Tools have been created specifically for use in Washington (Maletzke et al., 2017) which can aid in that endeavor. A recent publication on cougar connectivity using genetic samples obtained from Washington (Zeller et al., *In Press*) demonstrated that resistance to gene flow increased with increasing values of agriculture, building density, and road density, for both sexes.

Not surprisingly, resistance was high across the Columbia Basin, however, the Olympic Peninsula also showed high impacts of these habitat features. Connectivity was low for male cougars in and around the Olympic Peninsula, and they showed low genetic variation due to few immigrants finding their way into the population. Males and females responded to different habitat features and at different scales regarding dispersal events. Females were more impacted by smaller-scale features than males, likely due to their smaller movements.

Human-Wildlife Interactions

Minimizing human-wildlife conflict is a management priority for WDFW. Washington's human population is estimated at almost 8 million people, double what it was in the 1970s, and is expected to increase. With more people comes more recreationists in cougar habitat, more small livestock farms around residences, and more intentional and unintentional feeding of wildlife around homes. Therefore, WDFW must use a comprehensive outreach and information program to reduce negative human-wildlife interactions.

Overwhelmingly, the common causes of interactions identified by staff include feeding deer and turkey, bringing cougars closer to human development, and husbandry practices of small 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 mandatory for staff response to potential conflict events.

Current outreach materials include a cougar brochure and new signage for trailheads. In 2021, WDFW collaborated with external organizations on a manual to help small livestock owners minimize conflict (Figure 5); these items are available at WDFW regional offices and on the WDFW website. Staff also produced videos that provide information on (a) Cougar territoriality, (b) Tips for cougar encounters, and (c) Hiking in Washington cougar country. Agency staff has also reported on interaction rates and ways to reduce human-cougar interactions (Kertson et al., 2011; Kertson et al., 2013; Maletzke et al., 2017; Kertson & Keren, 2021).

It is expected that the pre-emptive recommendations outlined in the materials referenced in this section, including improving husbandry practices of small livestock raising activities and eliminating ungulate feeding activities, will help reduce human-wildlife conflict, which is almost always avoidable with preventative measures.

Figure 5. Recently developed education /outreach materials including a guide for avoiding conflict with wildlife when raising small backyard livestock, a trail/kiosk sign informing outdoor users that they are entering wildlife habitat, and an education brochure on cougars in Washington, Washington Department of Fish and Wildlife.

Population Augmentation

No population augmentation takes place for cougars in Washington.

Research

Over the past 24 years, 1998-2022, WDFW has funded or co-funded numerous long-term cougar research projects resulting in almost 35 peer-reviewed manuscripts 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 most recently concluded project involving cougars is a predator-prey research project which started in 2016 and recently ended in 2020; analysis is underway. 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. In 2022, two genetics research projects were published using DNA from all known cougar mortality in Washington.

The first was an account of sex-specific differences in gene flow and functional connectivity for cougars (Zeller et al., 2022). The second was genetic diversity and source-sink dynamics of cougars in the Pacific Northwest (Wultsch et al., 2022). Also, in 2022, staff collaborated on a review of model-generated cougar density estimates, which revealed sources of bias and variation and the need for standardization (Murphy et al., 2022). That study demonstrated that range-wide density estimates of cougars are not as variable as once presumed, which strengthens density estimates published by WDFW staff and presented in Beausoleil et al. (2021).

Management Concerns

Exceeding harvest beyond management objectives can be a concern in certain areas and has the potential to impact cougar populations at the PMU level. On average, 29% of PMUs close within a given hunt season (range = 16-50%), and of the 45 PMUs with harvest guidelines, 14%, on average, go beyond the upper end of the guideline.

Over half of the overages occur before January 1, when harvest limits do not yet apply, and the remaining closures occur after harvest guidelines take effect. Percent female harvest should be monitored closely as changes in adult female and kitten survival are the most influential parameters to population growth (Martorello & Beausoleil, 2003). Over the past ten years, female harvest has averaged 54%. Also, because PMUs close based on the estimated field age of harvested animals, correctly categorizing age class in the field is crucial and we are constantly working to improve field aging.

Non-harvest mortalities (mostly agency removals) have increased since 2018 (Figure 3), currently averaging 123 animals statewide. It is unknown how this large increase changes the growth rate of the population and we should work to reduce non harvest mortality as much as possible.

Zeller et al. (*In Press*) also highlighted areas of lower connectivity and relatively intact connectivity along Interstate 5, providing potential corridors into and out of the Olympic Peninsula between Olympia, Washington, and Portland, Oregon. With these maps, wildlife managers can collaborate with other land managers with the intent of earmarking areas for protection, enhancement, and possibly even for wildlife crossing structures, thus aiding in wildlife dispersal and enhancing and perpetuating the exchange of genetic material.

Management Conclusions

WDFW is in the process of updating and revising the Game Management Plan (GMP). In addition to evaluating the impacts of the 2020 hunting structure changes in the new GMP, incorporating the increase in non-harvest mortality needs evaluation to ensure the Department's goal of population stability at the PMU level.

Having a hunt structure that is more responsive to hunting conditions would improve the Department's ability to manage harvest and direct hunters to nearby open PMUs during optimal hunting conditions. Potential considerations include: a) implementing a single-season hunt structure with harvest guidelines being applicable throughout; (2) Removing April from the hunting season, which crosses license years requiring an additional license purchase and creating confusion; and (3), work to improve tribal relations and data sharing to document tribal-related mortality of cougar which would improve the ability to assess if the agency is meeting management objectives. Further developing a cougar outreach and information program focused on pre-emptive techniques is crucial to decreasing human-cougar interactions.

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Black Bear

Black Bear Status and Trend Report

STATEWIDE

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Introduction

Black bears (*Ursus americanus*) are a native species in Washington and occupy the forested areas throughout the state. Only the northern island counties within the Puget Sound archipelago and the shrub-steppe habitat of the Columbia Basin do not support resident black bear populations. Black bears are active at all times of the day, so it is not uncommon for humans to see bears moving through the landscape. Black bears are generally solitary by nature, except females with young, and only come together to mate or feed at abundant seasonal food sources. The ecological importance of bears is significant as they are crucial seed dispersers and play a vital role in plant distribution. Overall, black bears in Washington predominantly consume vegetation, with the remaining composed of animal matter including insects, mammals, and fish. Their diet contributes to healthy ecosystems by providing food for other mammals, birds, and insects, which deposit nutrients and enrich soils for future plant growth. Bears are also scavengers of dead animals, which adds to those benefits.

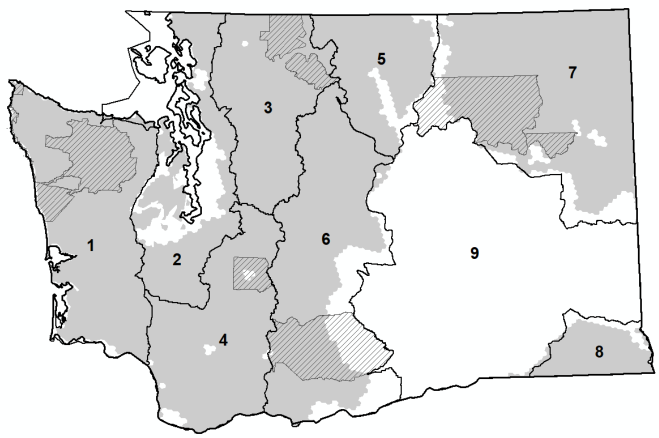


Figure 1. Black bear distribution (in gray) and 9 black bear management units in Washington, 2022. Hashed areas represent National Parks and Tribal land.

Management Guidelines and Objectives

Black bears are an important game species in Washington, and agency objectives include managing for a variety of recreational, educational, and aesthetic purposes (WDFW, 2015). Management to preserve, protect, and perpetuate black bears and their habitats to ensure healthy, productive populations while minimizing conflict with people are goals outlined in WDFW's Game Management Plan (WDFW, 2015). WDFW has made acquiring a better understanding of bear abundance, density, and growth rate a management priority which will improve harvest management.

For management purposes, the state is divided into nine 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. These BBMUs are based on ecoregions and WDFW game management units (WDFW, 1997).

Table 1. Current black bear harvest guidelines in Washington which are applied to each Black Bear Management Unit (BBMU).

Parameter	Harvest: Liberalize	Harvest: Acceptable	Harvest: Restrict
% Female in the harvest	< 35%	35-39%	> 39%
Median age of harvested females	>6 years	5-6 years	< 5 years
Median ages of harvested males	>4 years	2-4 years	<2 years

WDFW monitors hunter effort, median ages of harvest, and sex of kill to infer population size and trend (Table 1, Table 2) (Beecham & Rohlman, 1994) and the percent females of hunter harvest to monitor trends within 9 Black Bear Management Units (BBMUs, Table 3) throughout the State (WDFW, 2015). Unfortunately, median ages and percent female metrics may not accurately detect or be sensitive to changes in population trajectory as the same statistics could be seen on both increasing and decreasing trajectories (Beston & Mace, 2012; McLellan et al., 2017). The department will begin revising the objectives and guidelines in the upcoming Bear Management Plan, incorporating empirically derived black bear density estimates (WDFW, 2022) to calculate abundance, and establishing targeted harvest rates by area; this will be supplemented by sex and age data. Black bear density is not uniform across the landscape. It can vary based various factors, including habitat quantity and quality, development, and levels of hunting and non-hunt mortality (Welfelt et al., 2019). Utilizing this new information will further inform and improve management.

Table 2. Median ages of 4,467 black bear mortalities, by sex and year in each BBMU, submitted in Washington, 2012-2021. Gray areas show where management objective was exceeded.

BBMU	2012		2013		2014		2015		2016		2017		2018		2019		2020		2021	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1	4	5	3	7	4	4	4	5	4	5	4	6	3.5	5	4	5	4	4	4	6
2	3	5	3	6	2.5	2	2	4	2	4	3	4	3	2	3	6.5	3	5	3	6
3	5	6	5	6	4	8	5	9	4	6.5	3	5	3	4	3	4	4.5	6	4	3
4	3	5	3	3	3	5	3	7	4	5.5	3	4	4	4	4	4	4	4	3	7.5
5	6	6	3	2.5	3	3	1	4	3	1	3	6	2.5	2.5	4	2.5	3.5	4	5	2
6	4	4	4	4	2	7	3	5	4	4	4	4.5	3	5	3	5	4	5	4	3.5
7	5	5	4	4	2	3.5	3	5.5	4	7	3	5	3	6.5	3	5	3	5	4	6
8	3.5	4.5	5.5	3	5	7	3	3.5	2.5	4	5	3	3	3.5	3	4	4	5	3	3.5
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	N/A	N/A	4	N/A	N/A	N/A	N/A	N/A
Statewide	4	5	4	5	3	4.5	3	5	4	5	3	5	3	5	3	5	4	5	4	5

Table 3. Percent female black bear mortality, by year and BBMU in Washington, 2012-2021. Gray areas show where management objective was exceeded.										
BBMU	**Percent Female Mortality**									
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
1	30	32	28	27	29	35	36	31	36	28
2	36	42	39	34	43	35	33	26	24	23
3	36	32	38	31	42	26	40	27	29	30
4	31	31	44	24	37	35	40	27	33	28
5	33	27	32	27	32	36	38	31	36	32
6	27	30	34	34	35	31	34	27	34	26
7	33	31	33	34	32	37	33	27	31	34
8	35	29	29	38	37	29	43	42	29	38
9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Population Surveys

No formal population estimate has been used for black bear management in Washington. However, Department staff are currently working to gather density information throughout the state, and new population estimates can be derived from those densities. Results from a research project in the North Cascade Mountains showed that while density averaged 20 bears/100 km^2 in a western Cascades study area and 19 bears/100 km^2 in an eastern Cascades study area, density varied within each site depending on human development and habitat productivity (Welfelt et al., 2019). Because these results showed that density could vary widely by habitat types within limited areas, it was determined that they should not be extrapolated statewide or even region-wide, given the variability of habitats that occur in Washington. Towards that end, WDFW biologists performed simulations to establish a sampling design and protocol that could be applied at a broader scale to obtain black bear density estimates throughout the state while minimizing staff time, materials, and expense to the agency. The Department has now completed field work for black bear density monitoring projects in 11 of the 15 Districts throughout the State where black bears occur (WDFW, 2022; Figure 2) using consistent methodology. Of these, nine Districts have density estimates that have already been derived; two additional estimates are pending with DNA samples currently under lab analysis. In collaboration with WDFW, the Stillaguamish Tribe used similar methods in 2021 and 2022 to estimate density in two separate areas of NW Washington and the Muckleshoot Tribe also conducted density work using WDFW guidelines. Altogether, WDFW now has empirical data from 14 black bear research areas which will help inform variations in density across habitats in Washington.

Since 2013, 12,283 samples have been retrieved from non-invasive barbed wire hair stations statewide, subsampled, and 6,659 samples were submitted for independent lab analysis (Table 4), and results are presented in Table 5. This monitoring project is anticipated to be replicated in additional areas across the state into the foreseeable future. This initial work was conducted in good bear habitat and should be replicated in lower quality habitats. With multiple density estimates in a variety of habitats, WDFW can examine what habitat and human factors are associated with black bear density across Washington. Continued monitoring will also allow for appropriate inferences of trend to be made regarding harvest levels and the effects of management actions.

Table 4. Annual black bear monitoring results using non-invasive DNA collection on 324 km^2 study areas (each with 36-9 km^2 cells), by GMU, WDFW 2022.

Year	Study Area GMU(s)	Samples Collected	Subsampled for Lab Analysis	Total Detections[a]	Individuals Identified[a]
2013-2016[b]	245	1,113	387	164	117 (56M:62F)
2013-2016[b]	454/460	852	335	145	93 (49M:44F)
2019	117	1,260	736	212	103 (50M:53F)
2019	672	298	292	59	28 (16M:12F)
2020	550/556	181	107	16	14 (8M:6F)
2020	654	1,168	498	158	74 (34M:40F)
2021	162/166/169	779	659	156	98 (55M:43F)
2021	218	1,419	778	309	100 (65M:35F)
2021	418	1,323	770	209	92 (40M:52F)
2021	437/448[c]	613	462	169	96 (50M:46F)
2022	560/572	2,263	1,036	pending	pending
2022	615	1,014	599	pending	pending

[a] Including cubs
[b] Used annual average from the 4-year study (Welfelt et al. 2019) for comparison purposes.
[c] Stillaguamish Tribe project

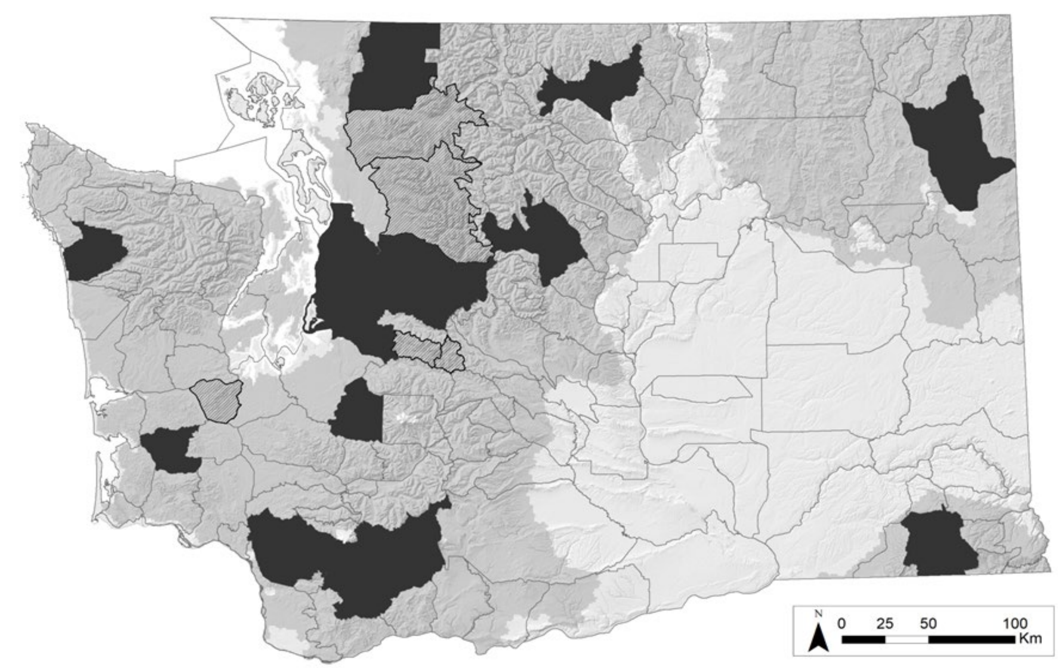


Figure 2. State of Washington with black bear habitat (gray) and Game Management Units (GMUs) shown. Highlighted GMUs (117, 162, 166, 169, 218, 245, 418, 437, 448, 454, 460, 550, 556, 560, 572, 615, 654, and 672) show where black bear density research was conducted. Additional density research areas (GMUs 466, 485, and 663) are also shown and depicted with hashmarks. Washington Department of Fish and Wildlife, 2022.

Table 5. Results of black bear density monitoring and subsequent estimates of harvest rate in Game Management Units (GMU) in Washington, 2013-2021, Washington Department of Fish and Wildlife.

Study Area GMU	Bear Habitat (km^2)	Average Total Density (bears/100km^2)	Estimated Abundance >1-year old[a]	2019-2021 Average Annual Harvest[b]	Estimated 2019-2021 Average Harvest Rate
117	2450	31.1	610	77 (13S:64F)	13%
162/166/169	1306	40.5	423	47 (15S:32F)	11%
218	1173	21.6	203	19	9%
245	1504	19.2	231	24	10%
418	2139	28.3	483	85 (8S:77F)	18%
437/448[c]	5197	25.7	1071	91	8%
454	1091	18.7	163	15	9%
460	2401	25.4	487	34	7%
550/556	1468	7.6	89	12	13%
654	842	16.9	114	29 (1S:28F)[d]	25%
672	662	7.7	41	21	51%

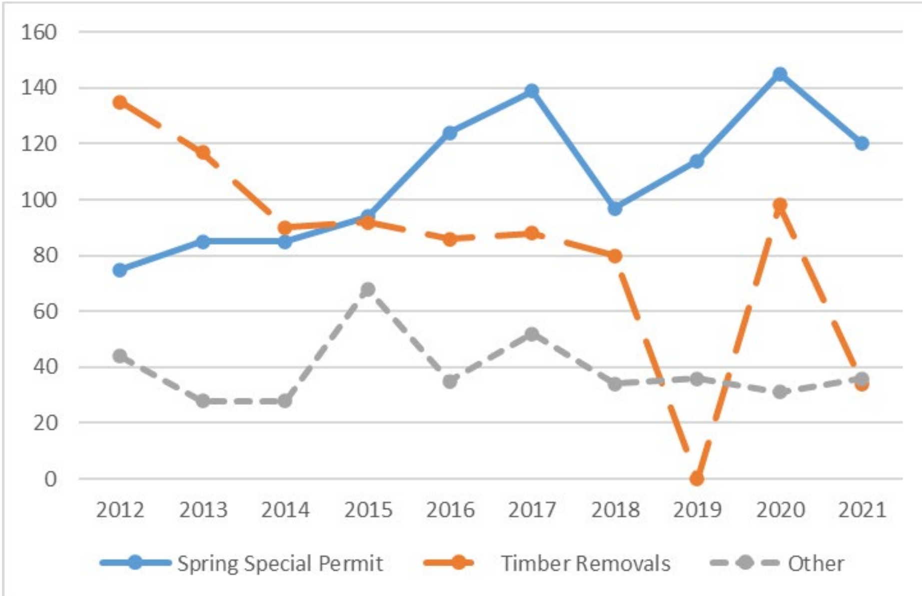
[a] Total abundance reduced by 20% to remove cubs of the year
[b] Tribal harvests not included. Spring (S) special permit and fall general season (F) hunts included where appropriate.
[c] Stillaguamish Tribe project
[d] Special permit hunts did not occur in 2020 or 2021

Hunting Seasons and Recreational Harvest

In 2021, the Department provided a total of 184 hunt days for spring and fall recreational hunting opportunity for black bears. An average of 63,000 licenses for black bear hunting are sold annually (Table 6), including both black bear-specific licenses and those sold in multi-species packages. Spring hunting is by special permit only and authorized in specified areas, whereas fall hunting licenses can be purchased over the counter, has no limit, and hunters can hunt anywhere hunting is legal; the bag limit is currently two black bears annually. In 2019, WDFW increased the bag limit of bears from one to two in eastern Washington and standardized season length across the state (August 1-November 15). A mandatory carcass check for Spring special permit hunts was initiated in 2020, however, due to concerns over the spread of COVID-19 it was not implemented until 2021, in which compliance was estimated at 100%.

Table 6. Black bear licenses sold 2012-2021, Washington Department of Fish and Wildlife.

	License Year									
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1st Bear	56,393	57,832	58,291	60,864	62,032	62,861	63,720	64,743	56,561	77,018
2nd Bear	452	376	423	497	433	418	415	1,023	785	894
Total	56,845	58,208	58,714	61,361	62,465	63,279	64,135	65,766	57,346	77,912



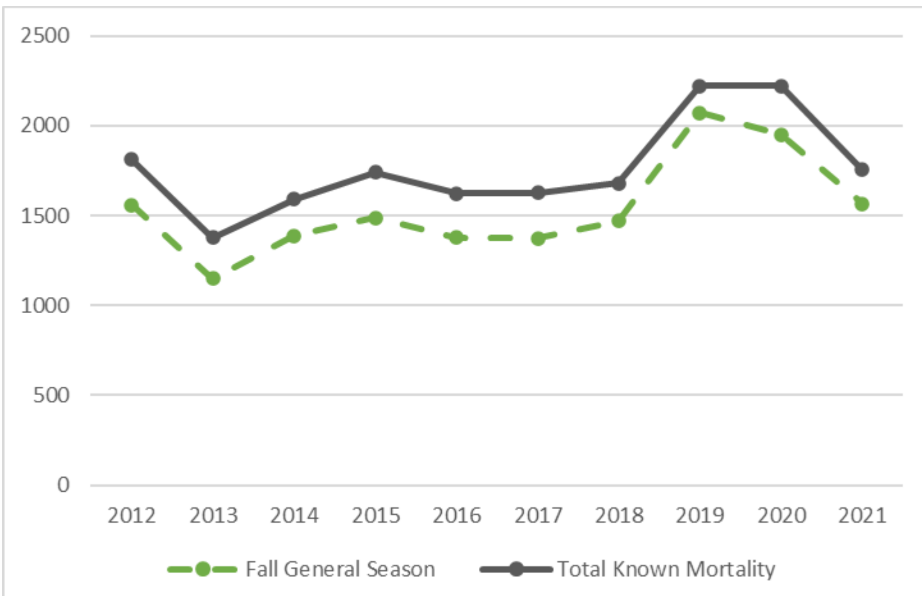


Figure 3. Black bear mortality for spring special permit hunt, timber removals, and other (top) and fall general hunt and total mortality (bottom), by year, in Washington, 2012-2021[abc]

[a] Does not include tribal harvest

[b] Other includes conflict removals, roadkill, and unknown mortality type.

[c] Timber removals did not occur in 2019. 2021 data includes 32 USDA Wildlife Services and 2 WDFW authorized removals

Over the past ten years (2012-2021), Washington's average annual black bear mortality was 1,764. The average fall harvest over the past five years (2017-2021) was 1,686, and spring harvest was 123. The previous five years (2012-2016) averages were 1,392 and 93, respectively. Fall general season harvest increased approximately 40% statewide in 2019 and 2020 from the average of the previous five years (2014-2018; Figure 3). It is unclear how the liberalization of the bag limit and season length affected these numbers, and harvest numbers returned to the average range in 2021.

When viewed by mortality type at a statewide level over the past ten years, most black bear mortality occurs in fall hunting season (87%), followed by spring special permit hunts (6%) and timber removals (5%) (Figure 3). Tribal black bear harvest occurs statewide, and reporting varies by tribe, thus is not included in WDFW reports. For example, in 2021, the Northwest Indian Fisheries Commission reported an additional 31 bear harvests split between BBMUs 1, 2, 3, & 4.

WDFW collects hunt fall statistics via online reporting. Currently, the reporting rate is about 65%. This mandatory report is followed up with a non-response bias survey to ensure that the data collected are statistically sound. The Department uses those data to determine the number of harvests, sex of harvests, number of days hunted, and GMUs hunted to calculate hunter success. Mortality from hunters mistaking threatened grizzly bears for black bears is a concern for grizzly bear recovery in the Western US. To reduce the potential impact in Washington, hunters who choose to hunt in GMUs in areas identified as grizzly bear recovery by WDFW must complete an annual online bear identification test and score 80% or higher. Agency staff also created a bear identification video in 2020, which is located on the WDFW website. Although not currently prohibited by law, WDFW urges hunters not to shoot cubs or a female with cubs.

Survival and Mortality

Human-caused mortality is the primary source of mortality in almost all black bear populations throughout North America. Research projects conducted in Washington demonstrate that non-harvest mortality can be an important factor in overall survival rates (e.g., Koehler & Pierce, 2005; Beausoleil et al., 2012). In the ongoing North Cascades black bear research project (2013-current), where 270 individual 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, 19% were conflict removals, 9% were poached, 7% were wounding loss, 7% were roadkill, and 7% were from natural causes. On the east slope of the North Cascades, 64% were hunter kills, 15% were natural causes, 8% were from wounding loss, 7% were conflict kills, 4% were roadkill, and 2% were poached. Of the bears that died from natural causes, most were yearlings recently separated from their mom, which died from starvation, predation (adult male bear or cougar), or other unknown natural causes.

Black bear population dynamics are driven by survival and reproduction rates, immigration (animals coming into the area), and emigration (animals leaving the area). Both natural and human factors can impact all these factors. For example, a berry crop failure can increase human-caused mortality as bears move closer to people in search of food and decrease reproduction rates for adult females through lower body condition. Understanding these population dynamics and how management actions may affect them is essential to maintaining a viable population and establishing sustainable harvest rates.

Habitat

Black bears occupy 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. Washington is the smallest western states and has the least potential bear habitat at 108,000 km^2, with 93,000 km^2 within WDFW's management authority (Scheick & McCown, 2014). Approximately 43% of potential bear habitat is under state or federal ownership, while 32% is owned by industrial private timber companies, with variable land management practices. Because a variety of habitat and human factors can affect bear numbers, population density varies widely in different habitats throughout the state. Note that while large tracts of forested habitat may provide security for bear populations, areas with timber harvest activities or adjacent to human-populated areas where human access and disturbance is high may have lower black bear densities.

Human-Wildlife Interaction

Human-bear conflict activity typically 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 occur in King County, 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).

Figure 3. Educational materials created in partnership with BearWise.

Additionally, homeowners are advised to practice good animal husbandry, including using enclosures and/or electric fencing for chickens and other small-medium sized livestock (e.g., goats and sheep) and keeping enclosures away from forest edges. Unfortunately, once bears know about a non-natural predictable food source or are intentionally fed by humans, they often return to that place, and many become more willing to take risks to acquire food. Recent wildfires and prolonged drought can exacerbate human-bear conflict because there are few natural foods to return to.

Along with other wildlife agencies, WDFW has become a member state in the BearWise program that creates and distributes educational materials regarding human-bear conflict to agencies and their public. A team of North American bear biologists and communications professionals manage the BearWise program with the Association of Fish and Wildlife Agencies' support. The goal is to create consistent and accurate human-bear conflict messaging across the country (Figure 4).

Population Augmentation

No population augmentation takes place for black bears in Washington.

Research

Welfelt et al. (2019) are 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 manuscripts will include growth rates (survival and reproduction), bear denning ecology, and stable isotope analysis to examine the impacts of human foods on black bears and human-bear interactions. Since the North Cascades bear project was concurrent with an ongoing cougar research project, the staff is partnering with a Ph.D. from the University of Washington to compare GPS collar data from black bears and cougars and examine resource selection and interactions between these two species in western Washington. One manuscript from that work has been submitted to a scientific journal and is currently in review. Density monitoring statewide by WDFW staff is summarized in a report titled "Estimating the Statewide Black Bear Population in Washington: A Cross-Region and Interagency Team Approach" (WDFW, 2022).

Management Concerns

Updating and improving the criteria used for population estimation and evaluating harvest objectives would improve agency management considerably. Many wildlife management agencies have moved away from using median ages and percent females in the harvest and use specific harvest rates based on density estimates as their management objective, as it is well documented that black bear densities can vary considerably. Using density estimates from ongoing research conducted throughout the state to derive abundance will allow staff to establish and evaluate harvest rates at a more localized scale. Density estimates are the most notable addition available to managers in Washington, which will be useful and relevant in developing updated management issues, objectives, and strategies. Therefore, the current priority for advancing and improving black bear management in Washington is to incorporate 2013-2022 density estimates into the management plan currently under revision and to continue monitoring densities statewide and refining densities, other demographic information, and creating a habitat-based density model in the foreseeable future.

Improving response rates for hunter reporting (~65%) and mandatory tooth collection (~25%) remains a concern. A mandatory pelt and skull inspection requirement for spring black bear special permit hunters was adopted and began in 2021, with high compliance rates. This will serve as a test of hunter responsiveness as well as agency staff workload for managers to evaluate. Collecting teeth from harvested black bears is one of the least expensive and time efficient tools managers have available to aid in harvest evaluation, and it fosters a working relationship with the hunting public, through engaging partners in management.

Overwhelmingly, human-bear conflicts involve attractants being provided by people including garbage, bird feeders, and fruit trees. The following actions would go a long way to reducing this conflict: Working with city councils on contract renewals for garbage management and expanding the options for bear-resistant containers and dumpsters for residents and businesses would be impactful. Establishing ordinances, bylaws, and disclosures at the local level to address garbage, bird feeders, the raising of chickens and other backyard livestock, and informing new residents that they live in bear country. Working with homeowners' associations on developing focused ordinances and covenants/bylaws that restrict the use of seed and liquid bird feeders, and placement of trash the day of pickup and not the night before has been shown to be highly effective in reducing human-bear conflict. Informing and training orchardists on the disposal of unmarketable fruit is needed as it is a significant and rewarding attraction to a bear and often brings bears closer to developed areas.

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Furbearer

Furbearer Status and Trend Report

STATEWIDE

LINDSAY WELFELT, Carnivore Section, Statewide Furbearer & Bear Specialist

Introduction

Furbearers are a collective term representing a diverse group of wildlife that perform a variety of roles in the ecosystems of Washington. They include species from rodents to carnivores, each with unique habitat needs, relationships with other wildlife, and impacts on people. This varied group exhibits a wide range of growth rates, habitat requirements, human tolerance, and historic and current harvest levels. Some species have high population growth rates, and human-caused mortality is often considered compensatory, so the risk of over-exploitation is low. However, other species are long-lived, have relatively low reproductive rates, and specific habitat needs, which make them at higher risk of the impacts of human-caused mortality. The eleven species that are classified as furbearers in Washington state include American beaver (*Castor canadensis*), American badger (*Taxidea taxus*), bobcat (*Lynx rufus*), ermine (*Mustela erminea*), long-tailed weasel (*Mustela frenata*), marten (*Martes americana*), mink (*Mustela vison*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), and river otter (*Lutra canadensis*). Bobcat, raccoon, and red fox are also cross-listed as small game species in Washington.

Management Guidelines and Objectives

Furbearer management is currently administered under the 2015-2021 Game Management Plan (WDFW, 2014). Statewide management goals for all furbearers are to:

1. Preserve, protect, perpetuate, and manage species and their habitats to ensure healthy, productive populations.
2. Manage wildlife species for a variety of recreational, educational, and aesthetic purposes including hunting, trapping, scientific study, cultural and ceremonial uses by Native Americans, wildlife viewing, and photography.
3. Manage statewide populations for a sustained yield.

Trapping Seasons and Recreational Harvest

The trapping season for furbearers occurs during the winter months, November 1 – March 31. Trapping occurs on most public lands statewide, with no restrictions or bag limits, except the closure of marten trapping on the Olympic Peninsula in Clallam, Jefferson, Mason, and Grays Harbor counties to protect low-density coastal Pacific martens (*Martes caurina*). For the past ten years, 2012-2021, an average of 556 fur trappers have been licensed in the state annually, trending up over this time (Figure 1). A substantial decrease in furbearer harvest is correlated with the passing of I-713 in 2000, which banned most body-gripping traps for recreational trapping.

(Figure 2). In addition to past regulatory changes, current harvest numbers likely fluctuate due to several factors, including population levels, pelt prices, trapper numbers, weather, access to trapping areas, and public interest.

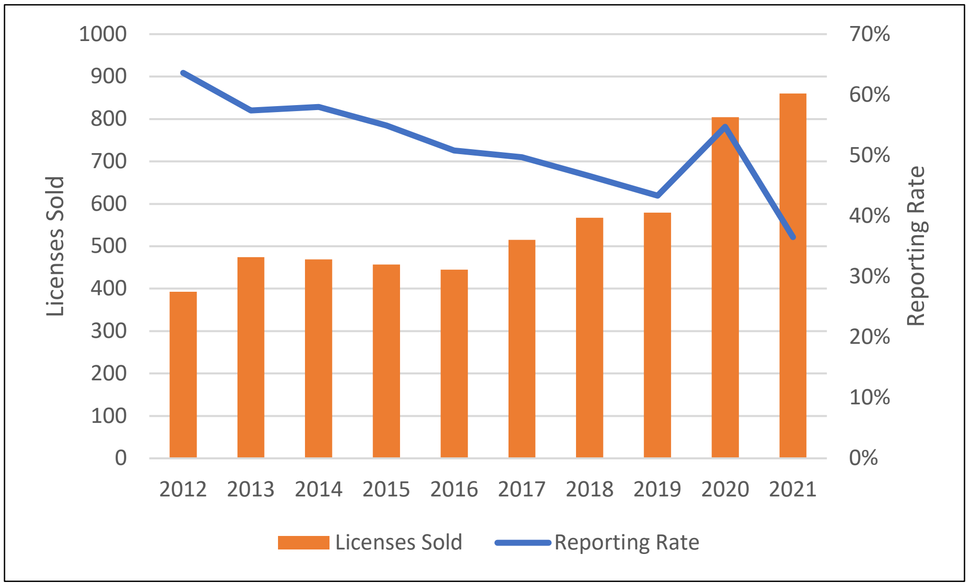

Figure 1. Trapping license sales and reporting rates in Washington, 2012-2021.

State law currently restricts body-gripping traps for recreational trapping; cage and box traps, suitcase-type live beaver traps, and common rat and mouse traps are not considered body-gripping traps (RCW 77.15.192). WDFW trapping regulations also require wildlife caught in restraining traps to be removed within 24 hours and kill traps checked and animals removed within 72 hours.

Information on harvest numbers for most furbearers comes from trapping reports, which historically have been mailed or emailed documents describing an individual's trapping activity and outcomes. Trapper reporting rates have averaged ~ 55% for the past ten years (2012-2021), with a decreasing trend (Figure 1). Due to this declining trend, and the development of the furbearer program in recent years, online electronic trapper reporting in the WDFW WILD licensing system began in the Fall of 2022, similar to all big game species reporting.

The department expects both reporting rates and the accuracy of reports to improve. Additionally, all bobcat and river otter pelts must be inspected and sealed by WDFW staff or an authorized individual permitted by the department per federal CITES requirements (Figure 3). Compliance with these requirements is estimated to be high, and harvest numbers of bobcats and river otters are some of the most accurate of all game animals.

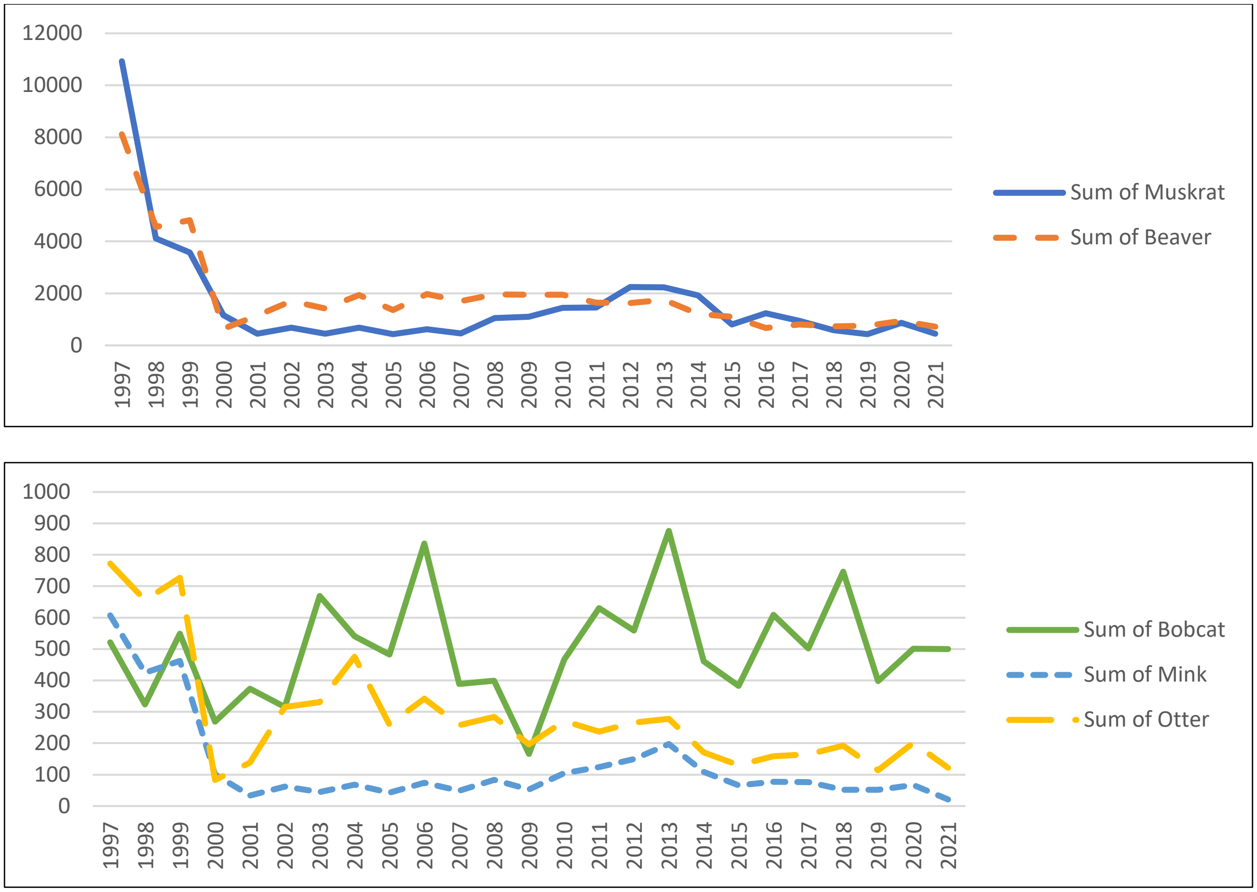

Figure 2. Long-term reported harvest data for commonly targeted furbearer species, 1997-2021. Trapping regulations changed in 2000 and harvest for many species declined. Scale varies between top and top and bottom graphs.

Furbearers cross-classified as small game species (bobcat, raccoon, and red fox) can also be hunted during the small game season, September 1 – March 15, in addition to trapping. Night hunting for bobcat is prohibited in GMUs that fall within the lynx management zones identified by WDFW (GMUs 101, 105, 111, 113, 117, 203, 204, 215, 218, 224, 231, 233, 242 through 247, 250, 426 and 450) to avoid incidental take of Canada lynx (*Lynx canadensis*).

Hunting of red fox is also closed within the Mt. Baker-Snoqualmie, Okanogan-Wenatchee, and Gifford Pinchot National Forests to avoid harvest of Cascade red fox. This subspecies occurs only in the montane environments of the Cascade Mountain Range.

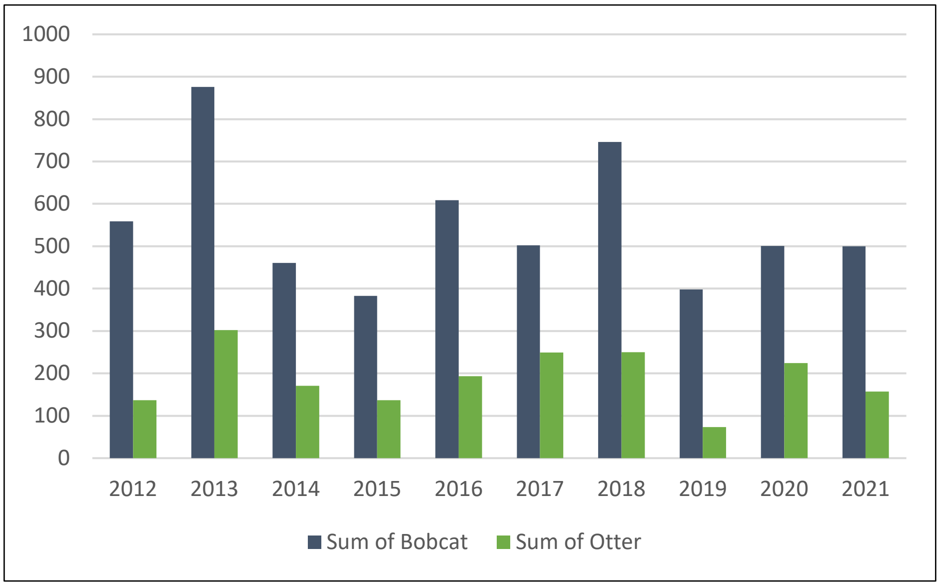

Figure 3. CITES harvest reports for bobcat and river otter in Washington, 2012-2021. The COVID-19 pandemic resulted in incomplete reporting for the 2019-20 season.

Population Monitoring

There is little documentation on the current distribution, relative density, and population status of many furbearer species in Washington. Habitat modifications, changes in prey availability, and human-caused mortality have the potential to impact many of these species in positive and negative ways. Trends in total harvest and catch-per-unit-effort are used as general indicators of population status and trends for some species. Factors such as fur prices and changes in allowed trapping methods, such as in 2000, should be considered when comparing harvests from different years.

The 2015-2021 Game Management Plan identified the need to assess population status on a local, regional, and statewide basis via the development of population surveys, research projects, and distribution maps from existing occurrence data. Collaborative research projects have been vital in filling in data gaps and addressing specific questions such as the population status of marten on the Olympic Peninsula (Moriarty et al., 2019) and the genetic structure of badger in Washington (Ford et al., 2019).

WDFW-funded research collaborations with the University of Washington and Washington State University to identify potential beaver habitats for restoration prioritization and population evaluation (Dittbrenner et al., 2018) and assess environmental DNA use to monitor the efficacy of beaver relocations. Information from these projects may be used to assist in beaver population monitoring. Recently, WDFW initiated a study with Washington State University to estimate bobcat density using camera detections, and work is expected to begin in the winter of 2022-2023.

Habitat

Furbearers occupy various habitats throughout the state ranging from freshwater aquatic ecosystems to montane forests. Below are examples of how a few of these species interact with their environment.

American badgers are considered a 'Species of Greatest Conservation Need' in Washington, as identified by WDFW. They are generally found in grassland, shrub-steppe, desert, dry forest, and agricultural areas. They require soils that allow the excavation of den sites and support the fossorial prey species (e.g., ground squirrels) they rely on. Many of the shrub-steppe habitats they occupy have stressors, including energy development, altered fire regimes, agricultural side effects, invasive species, and habitat loss and fragmentation. Actions to improve or secure habitat for badgers and other species that rely on these ecosystems consist of habitat conservation, fire management, invasive species control (particularly cheatgrass), grazing and farm management, and private lands incentives (WDFW, 2015). Observations of badgers in mid-high elevations in the eastern Cascades Mountains (e.g., King et al., 2021) suggest they may use these habitats more than previously thought. Future work may aim to understand better the environmental and human factors associated with their current distribution.

The American beaver's role in the environment is expansive. Beaver damming activities have historically played a substantial role in maintaining the health of Washington's watersheds, providing ecological benefits to wildlife, fish, and humans with increased water storage, suspended sediment reduction, and improved wetland habitat (Cooke & Zack, 2008; Dittbrenner et al., 2022). Historically, beavers were trapped out of many habitats in Washington. While populations have recovered with regulated management and are now harvested statewide (Figure 4), many of their historic habitats have incurred changes that no longer support beavers (e.g., development, habitat degradation, drought).

Beavers may also abandon a colonized site if the landscape no longer provides adequate vegetation, adequate water supply, or in areas with high stream power. In human-occupied areas, beavers' destruction of riparian trees and flooding often results in a human-wildlife conflict which can lead to negative attitudes of the public towards beavers (Krueger et al., 2021) and eventual lethal removal of beavers from conflict situations. Balancing the ecological benefits of beavers with the undesirable impacts on private property owners, agriculture, and infrastructure remains a WDFW management priority.

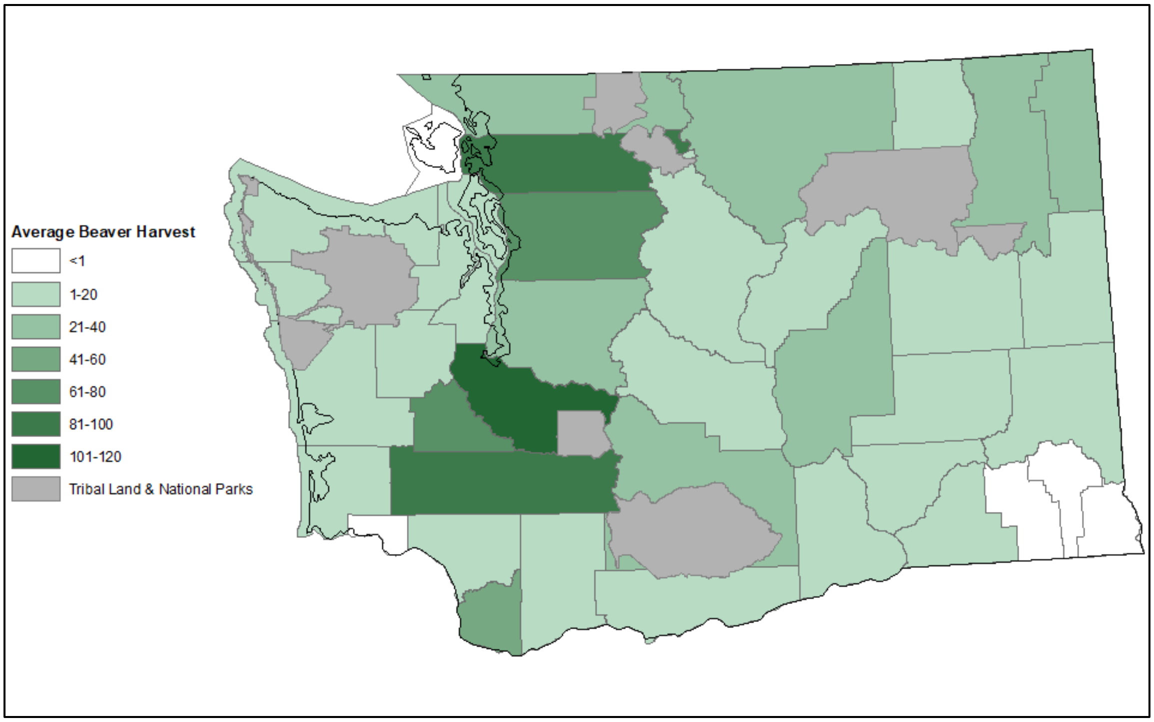

Figure 4. Distribution of beaver harvest in Washington counties, 5-year average 2017-2021.

Martens are habitat specialists, preferring mature forests at moderate to high elevations. They require dense canopy cover, woody structures, and large trees for denning sites and hunting arboreal prey such as squirrels. Martens tend to avoid open areas and can be sensitive to forest harvest practices, recreation, and road building (Moriarty et al., 2011). In addition, information on marten occurrence patterns may be valuable for predicting the abundance or occupancy of rare forest carnivores, such as fisher (*Pekania pennanti*). They are an essential focal species for evaluating connectivity among patches of mature forest.

Alternatively, raccoons are habitat generalists and occur throughout much of the state. Their varied feeding habits help to recycle nutrients and disperse seeds throughout the environment. Although they prefer wetlands and damp woods in natural habitats, their ability to thrive on human-supplied foods, such as pet food and unsecured garbage in urban and suburban areas, has made them pervasive in these environments. Consequently, raccoons are among Washington's top species cited in the human-wildlife conflict (Duda et al., 2014). Many are lethally removed due to human-wildlife conflict or killed in vehicle collisions. Understanding raccoons' adaptability and the causes of human-wildlife conflict may help residents minimize future conflicts.

Population Augmentation

The only augmentation for furbearer species in Washington is relocating beavers involved in human-wildlife conflict into unoccupied habitats. The Beaver Relocation Permit Program is administered by WDFW and permits trained and authorized individuals to relocate beavers to sites that meet specific habitat criteria.

The Washington State Legislature recognized the potential benefits of beaver relocation and passed RCW 77.32.585 in 2012, directing WDFW to permit the release of wild beaver to areas of Washington to derive ecosystem benefits such as water storage, suspended sediment reduction, and improved fish habitat.

In 2019, WDFW implemented a pilot program to issue permits that authorize beaver relocation. This program resulted from work with tribal co-managers, conservation organizations, and other state and federal agencies in the Washington Beaver Working Group to refine relocation and coexistence methods. The permit authorizes beaver relocation only in situations where beaver damage mitigation efforts have failed or are infeasible, where beavers pose a public health and safety risk, or other irresolvable factors that preclude in-place management or tolerance. Consequently, this relocation program presents an opportunity to use beavers as a wetland restoration tool while simultaneously offering landowners a non-lethal option for human-beaver conflicts and meeting the legislative requirement and objectives in the 2015-2021 Game Management Plan. For the first three license years, 33 permits have been issued (9 permits in 2019-2020, 13 permits in 2020-2021, and 11 permits in 2021-2022), and 71 beavers have been captured and removed from conflict situations (WDFW, 2022).

Management Conclusions

The WDFW Beaver Relocation Permit Program is currently in a pilot phase, allowing for an evaluation before establishing a permanent rule. Currently, in development, the rule will establish criteria for issuing beaver relocation permits and develop provisions for beaver capture, housing, transport, release site selection, and other aspects of relocating beavers from human-wildlife conflict situations. Public and stakeholder input has also emphasized the need for future rulemaking to more clearly define “common rat and mouse traps” (RCW 77.15.192) and their role in trapping furbearing wildlife.

The Washington Fish and Wildlife Commission recently listed Cascades red fox as a state-threatened species. As such, trapping regulations may need to be updated to reduce the chance of incidental harvest. Additionally, recent genetic research suggests that American marten (*M. americana*) and Pacific marten (*M. caurina*) likely occur in many Washington areas. However, the precise distribution and overlap zones are still unclear (Dawson & Cook, 2012). Classification of Pacific marten as a furbearer species, in addition to American marten, may be needed to ensure harvest regulations align with the best available science.

A revision of distribution maps of one or more species is an agency goal identified in the 2015-2021 Game Management Plan. To accomplish this, current occupancy and limiting factors of distribution may be gleaned from harvest and trapping data, citizen observations, habitat characteristics, prey distribution, and research and surveys. In addition to the electronic WILD licensing system improvements for trapper reporting beginning in 2022, enhanced reporting of non-harvest mortality (e.g., vehicle collisions, landowner kills, etc.) may provide a more comprehensive view of the impacts of all human-caused mortality. Together, these will allow WDFW to understand better population size and distribution, aid communication with the public and stakeholder groups, and provide a strong foundation for land and species management recommendations.

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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, but through coordinated banding efforts, estimates of absolute abundance are available since 2003 (USFWS, 2017; Seamans, 2022b). The proposed mourning dove harvest strategy aims to ensure the long-term conservation of mourning dove populations and minimize the frequency of regulatory changes where Washington is part of the Western Management Unit (USFWS, 2017).

Population Surveys

Methods

Band-tailed Pigeon call-count Survey

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 (then the 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 eight western Washington locations in 2001-03 (Overton & 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 & Casazza, 2004). The 15 sites included the eight 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 as it met the minimum criteria of a known naturally occurring mineral site and at least two 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. In 2020 and 2021, WDFW staff initiated marking studies to identify potential mineral sites, in regions of no historic records, with the use of GPS-quality transmitters, piloting the effort in the Chehalis River watershed and expanding to Clallam County drainages along the Strait of Juan de Fuca, in consultation with USGS and USFWS.

Mourning Dove call-count Survey

The mourning dove survey was discontinued by USFWS after the 2013 survey (Seamans & Sanders, 2014). See 'Banding and Harvest Recoveries' section below.

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, 2022, survey period, including an initial count at a potential new mineral site located using marked pigeons. Mineral site survey raw data summaries are presented in Table 2 and Figure 1. Complete 2022 survey results are available through USFWS (Seamans, 2022a).

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 were caused by low sample size due to changing observers from year to year.

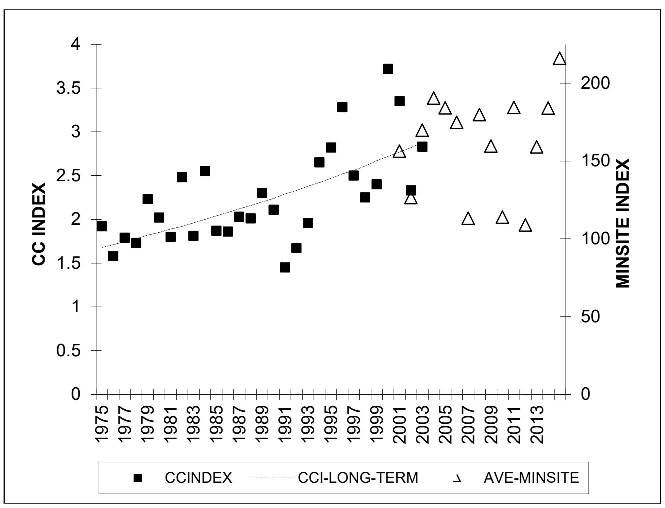

Figure 1. Band-tailed pigeon call-count results and mineral site raw data summaries.

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 season dates typically occurring between September 15-23 (9-day season by federal framework) and daily bag/possession limits of 2/6. The mourning dove season was September 1-15 from 1980 through 2007. Since 2008, season frameworks allow for the Western Management Unit to allow up to 60 days, with Washington selecting September 1 – October 30 with a daily 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, 2021).

Banding and Harvest Recoveries

Mourning dove season regulations are informed by harvest rates derived from banded birds annually deployed during operational pre-season efforts conducted since 2003 (Seamans, 2022b). WDFW staff have deployed bands on mourning doves at varying levels of effort since 1954, but most consistently since 2003, to assist in harvest management informed by derivation of annual survival and harvest rates for the Western Management Unit (WMU). These efforts are guided by the Mourning Dove National Strategic Harvest Management Plan, with the endorsement from all four flyways (USFWS, 2017). Banding quotas for 'known age' mourning dove are distributed within the states by Bird Conservation Regions (BCRs). As part of the Western Management Unit for mourning dove, Washington is tasked with banding in the three BCRs, with the Great Basin (BCR-9) responsible for 82% (229 of 279 known After Hatch Year, and 182 of 221 known Hatch Year) of the statewide expectation (Otis, 2009).

Results

Band-tailed Pigeon Harvest

Harvest and hunter activity for the 2002-2021 seasons are summarized in Figures 2 and 3, and Table 3.

Mourning Dove Harvest

As measured by WDFW (2021) small game surveys, harvest in 2021 was estimated at 42,458 doves, down 12.7% from 2020 and 14.4% below the recent 10-year average (Figure 4). Hunter numbers were estimated at 3,626, down 12.6% from 2020 and 7.1% below the recent 10-year average. The number of days hunted was estimated to be 12,696, down 2.0% from 2020. When the number of dove harvest per hunter is considered, the 2021 estimate of 11.7 dove per hunter is above the long-term average of 10.9 dove per hunter success rate since 1970 (Figure 4). The highest value was recorded in 2015 at 15.2 dove per hunter. This level of harvest per hunter consistently places Washington third among Pacific Flyway states with mourning dove harvest, behind only Arizona and California (Seamans, 2022b).

A total of 1,208 mourning doves were banded statewide, with 1,194 being used in analysis of survival and harvest rates (Seamans, 2022b; Table 4). A total of 67 banded mourning dove recoveries were reported by hunters during the 2021-2022 season. Most of the reported harvest recoveries were reported from Washington (63), one (1) recovery report each from Oregon, California, Nevada, and Utah (Figure 5). Within Washington, the majority of harvest recoveries were reported from the Columbia Basin and Yakima Valley, and no harvest recoveries reported from western Washington (Figure 5 inset).

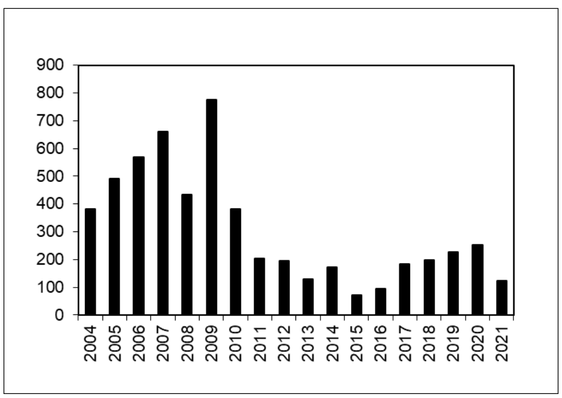

Figure 2. Band-tailed pigeon total harvest since 2004 when a season re-opened per Pacific Flyway Management Plan.

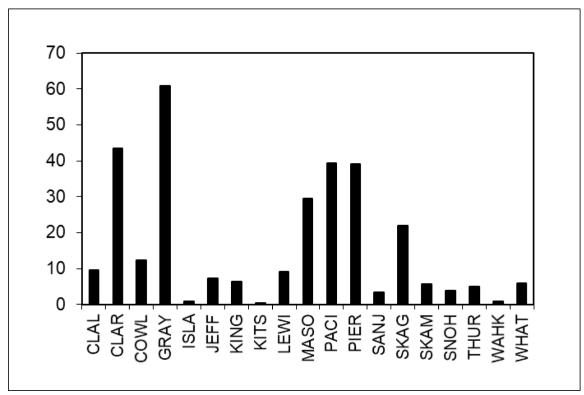

Figure 3. Band-tailed pigeon 2002-2021 average annual harvest by county.

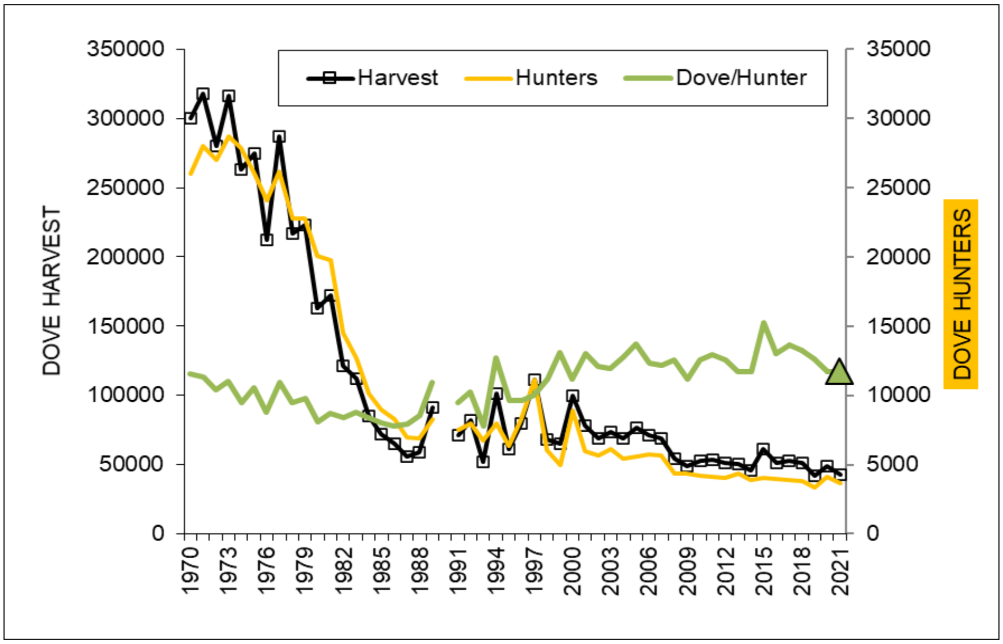

Figure 4. Mourning dove statewide harvest and hunter numbers 1970-2021. The dove per hunter average was 11.7 during the 2021 season (green triangle), above the long-term average of 10.9 dove per hunter.

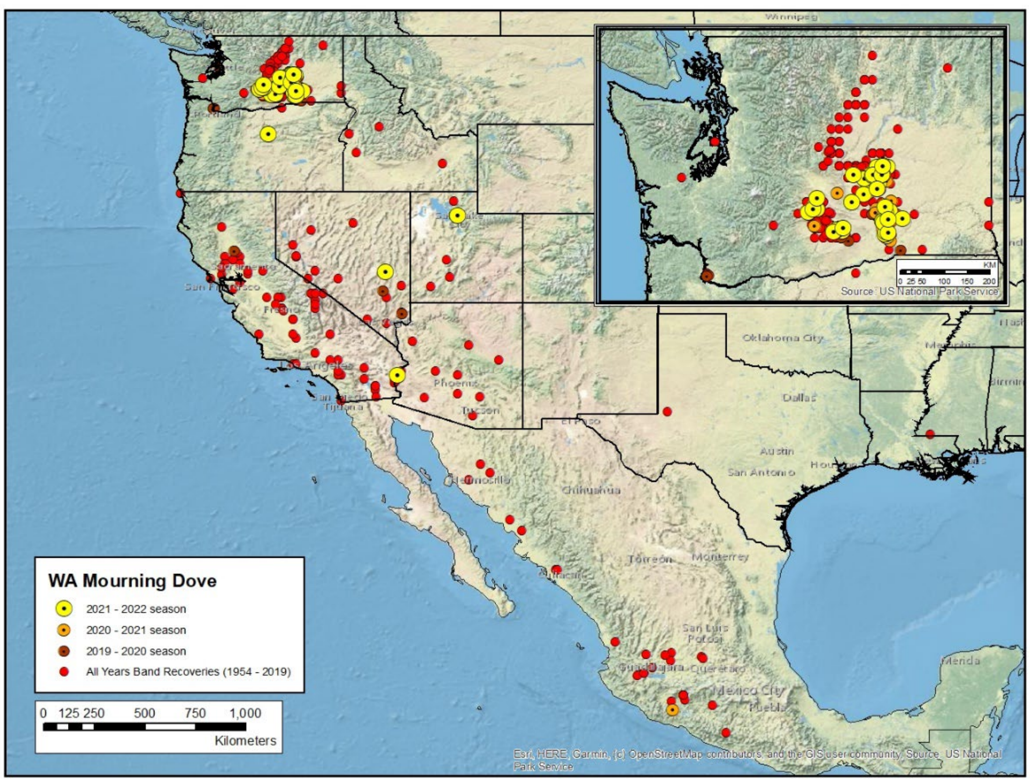

Figure 5. Mourning dove harvest recoveries from birds banded in Washington. Harvest recoveries from the 2021 season (n = 67; yellow dots) in comparison to harvest distribution patterns dating back to 1954.

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Table 1. Band-tail call-count survey results - route regression method.

Start Year	End Year	Change	Lower 90% CI	Upper 90% CI	Routes Used	Sig. level
1975	1992	-7.8%	-14.0%	-2.0%	63	p<0.05
1991	1992	10.1%	-50.0%	75.0%	11	n.s.
1975	1993	-6.0%	-11.0%	-1.0%	65	p<0.05
1992	1993	44.0%	-49.0%	152.0%	13	n.s.
1975	1994	-3.4%	-8.2%	1.4%	69	n.s.
1993	1994	71.0%	1.4%	141.0%	24	p<0.05
1975	1995	-2.7%	-9.8%	4.5%	70	n.s.
1994	1995	12.1%	-31.3%	55.3%	12	n.s.
1975	1996	-0.8%	-6.5%	4.9%	59	n.s.
1992	1996	24.3%	10.4%	38.2%	30	p<0.01
1995	1996	36.4%	-35.9%	108.7%	18	n.s.
1975	1997	-0.8%	-6.0%	4.3%	62	n.s
1993	1997	8.9%	0.2%	17.6%	32	p<0.10
1996	1997	-14.3%	-35.4%	6.7%	18	n.s.
1975		-1.5%	-5.5%	2.4%	65	n.s.
1994	1998	2.1%	-8.7%	13.0%	34	n.s.
1997	1998	-11.0%	-45.8%	23.9%	11	n.s.
1975	1999	-0.1%	-4.1%	3.8%	67	n.s.
1995	1999	-3.3%	-11.5%	4.9%	38	n.s.
1998	1999	26.7%	-19.7%	73.1%	14	n.s.
1975	2000	-0.3%	-6.2%	5.5%	70	n.s.
1996	2000	5.9%	-2.3%	14.1%	41	n.s.
1999	2000	21.1%	-12.5%	54.8%	24	n.s.
1975	2001	1.7%	-2.3%	5.7%	70	n.s.
1997	2001	15.8%	8.0%	23.6%	44	p<0.01
2000	2001	1.8%	-16.6%	20.2%	36	n.s.
1975	2002	0.7%	-3.7%	5.0%	71	n.s.
1998	2002	9.4%	2.6%	16.2%	45	P<0.05
2001	2002	0.9%	-27.5%	25.8%	32	n.s.
1975	2003	1.8%	-1.7%	5.4%	71	n.s.
1999	2003	0.6%	-4.8%	5.9%	48	n.s.
2002	2003	5.2%	-30.5%	40.8%	25	n.s.

Table 2: WA band-tailed pigeon mineral site survey raw data 2004-2022.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Altoona	64	0	5	0															
Cedar Cr.	215	185	231	191	312	163	154		142	181	267	207	306	246	145	308	187	190	117
Cosmopolis*																		664	
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	285	350	374
McAllister	124	174	87	25	136	46	134	107	102	77	78	90	105	111	78	44	96	97	102
Morse Creek^																		0	
Mud Bay	134	371	294	95	203	130	70	175	87	214	136	297	208	187	349	594	264	263	239
Oyster Cr. – Pigeon Pt.	474	542	293	157	331	314	190	344	121	51	39	14		6	226	75	188	126	290
Naselle River												184	115	37	42	292	107	199	36
Newaukum	634	167	335	309	219												486	125	255
Potlatch	297	285	306	168	295	480	129	297	288	333	254	506	406	396	556	718	465	474	240
Red Salmon	179	103	64	33	107	41		0	47	5		93		43		180	162	291	255
Soda Springs									58	112		193	259	246	106	101	89	220	125
St. Martins	220	128	191	189	141	210	214	439	180	308	354	435	507	83	279	283	126	313	209
Sumas	46		68					78	17	82	74	78		96	152	64	101	91	108
U. Kalama	110	225	327	120	350	317	111	368	258	245	187	322	321	243	471	539	476	704	286
Totten -Oyster Bay							119	53	101	192	332	486	388	308	221	443	365	424	328
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	3397	4531	2964

* = Cosmopolis (potential); located by 3 marked individual pigeons, site sampled for mineral concentration , count not official.

^ = Morse Creek (previously identified); revisited site identified by USGS report, but no pigeons were recorded during survey attempt.

Table 3: WA band-tailed pigeon harvest report summary

Year	Number of Permits Issued	Total Days Afield	Total Harvest	Rank by County (top 3)					
				County Name	#	County Name	#	County Name	#
2002	522	357	273	Grays Harbor	47	Clallam	37	Skagit	33
2003	657	337	574	Skagit	99	Pierce	82	Cowlitz	54
2004	766	209	383	Grays Harbor	104	Mason	48	Pacific	37
2005	809	382	492	Skagit	97	Grays Harbor	76	Mason/Pierce	62
2006	909	315	569	Pierce	85	Skagit	74	Pacific	73
2007	894	364	661	Grays Harbor	145	Mason	84	Pacific	80
2008	917	247	434	Grays Harbor	103	Pacific	82	Mason	59
2009	567	548	776	Pacific	136	Grays Harbor	129	Mason	126
2010	632	362	381	Grays Harbor	83	Pacific	56	Pierce	43
2011	178	151	205	Clark	48	Grays Harbor	47	San Juan	45
2012	237	195	196	Grays Harbor	55	Pacific	47	Pierce	34
2013	244	85	129	Pierce	42	Pacific	33	Grays Harbor	26
2014	266	191	172	Grays Harbor	55	Clark	44	Pierce	36
2015	249	96	72	Pierce	28	Clark	19	Cowlitz	9
2016	253	112	94	Pierce	28	Clark	26	Grays Harbor	18
2017	212	192	183	Clark	57	Pierce	34	Grays Harbor	31
2018	220	222	198	Clark	67	Grays Harbor	50	Pierce	34
2019	98	266	226	Clark	55	Grays Harbor	20	Pierce	17
2020	206	269	253	Grays Harbor	49	Clark	36	Pacific/Pierce	20
2021	734	157	123	Clark	46	Grays Harbor	31	Pierce	18

Waterfowl

Waterfowl: Breeding Populations and Production Status and Trend Report

STATEWIDE

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Introduction

This report summarizes waterfowl productivity data collected during 2021 and 2022 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. Monitoring indices, figures, and tables reflect the most recent information available and have been updated where field logistics allow.

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 (Table 1). Weighting factors were determined by the proportion of areas within the sampled strata. Observations were treated as complete counts within sampling units (transects or quadrats) with no corrections for visibility bias.

Due to concerns about the 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 new survey aims 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 eliminating Saddle Mountain from the Irrigated stratum. Overall, observers surveyed approximately 1,688 transect miles in eastern Washington over a 5-day period between May 2-6, 2022.

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 25-28, 2022.

The modifications to the survey design and areas during the initial years of the aerial survey created difficulties in comparing results across years. Survey results from 2009-2012 were reevaluated and standardized by matching strata boundaries to the survey boundaries used in 2013 to address this issue. 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 the 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 two and grouped birds (mixed or >5 males) by one. Lone hens are multiplied by one 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

Statewide, the total breeding duck counts decreased by 11.5% compared to 2019. The most recent total breeding duck counts numbered 133,734 (*SE* 18,964) within three eastern Washington strata (Table 2). Observations of mallards (Fig. 4) during the 2022 breeding population survey show wide distribution with varying densities across all strata. The most recent total mallards numbered 45,152 (*SE* 5,106). Ruddy duck was the second most numerous species on the survey (20,346; *SE* 16,954), followed by Gadwall (17,226; *SE* 3,975), Northern shoveler (9,828; *SE* 2,648), Cinnamon Teal (8,001; *SE* 1,412), Bufflehead (7,175; *SE 2,523*), and Scaup (6,377; *SE* 2,510; Fig. 5). The Potholes stratum comprised 56.2% of the total duck count in 2022, followed by the Irrigated stratum (27.7%) and the Highlands stratum (16.1%). Compared to the 2019 survey, 2022 total breeding duck counts decreased by 31.0% in eastern Washington (Fig. 6).

The most recent revised survey design for western Washington estimated the total breeding duck population at 85,948 (*SE* 6,972). Mallards numbered 42,222 (*SE* 5,368), followed by Green-winged teal 10,417 (*SE* 2,558), Wood duck (7,328 *SE 1,356*), and Ring-necked duck (7,014 *SE* 1,387; Fig. 7, Table 3). The North Puget Lowlands stratum held the majority of breeding ducks in 20 (48.9%), followed by the South Puget Lowlands (28.2%), Chehalis River Valley (9.8%), Hood Canal (8.1%), and Dungeness (5.0%; Fig. 8).

Duck Production Survey (Brood Survey)

Methods

The same sampling transects used during historic breeding duck surveys are used for brood surveys in the Potholes, Palouse, and Northeast strata (Fig. 1). These surveys are conducted from late June to early July. All broods observed are recorded by species. The number 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. The survey effort varied somewhat over the years. The surveys in the Columbia Basin were redesigned in 1995 by using six sample sites to provide an index to production to provide more consistency.

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 a greater value for long-term trends than for year-to-year changes. In 2020, WDFW initiated a survey re-design with three primary objectives; first, to better align brood production data with aerial survey strata statewide; second, to include wetland types (by the seasonality of water) as a component of stratification to account for landscape and environmental changes being documented across Washington; and finally, to design the survey protocol to allow a broader suite of partners and volunteers to participate expanding our coverage both spatially and temporally. These redesign efforts are being undertaken in an effort to better describe the status and pressures on waterfowl broods and their wetland habitats in Washington. This new survey protocol will be piloted in spring 2023.

Results

The brood survey is undergoing an evaluation to determine the feasibility of sampling design, efficiency, and repeatability. For 2022 only four brood observation routes were completed due to staffing shortages and issues with observability. They do not provide enough data to update 2022 numbers compared to the historic time series (Table 4). A total of 11 waterfowl species, 68 broods, and 296 ducklings were encountered. Canada goose and mallard were the most common waterfowl, with 25 broods with 99 goslings, and 21 broods with 94 ducklings observed, respectively. Other species encountered included (in order): blue-winged teal (4 broods/ 22 ducklings), cinnamon teal (3/14), green-winged teal (3/18), ruddy duck (3/11), Barrow’s goldeneye (3/14), American wigeon (2/14), hooded merganser (2/5), ring-necked duck (2/3), and scaup (1/2).

Canada Goose Breeding Population Survey

Methods

Since 2010, the aerial index for breeding geese has been used to monitor breeding geese throughout Washington consistent with the extent of harvest management strategies considered for this population. 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 5).

Results

The most recent 2022 Canada goose breeding index decreased about 14.9% statewide compared to the 2019 estimate but remains 14.5% above the 2010-2022 average when estimates are derived from the aerial Washington breeding population survey. The total eastern Washington index decreased about 27.3% compared to 2019 but remains 2.2% above the 2010-2022 average (Table 6). The number of geese observed during the breeding duck surveys is presented in Figure 10 and Table 6. 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. Observations of Canada geese (Fig. 11) in 2022 demonstrate variable density with lower distribution across strata.

No updated nest indices have been conducted since 2019. Historical time series in the upper, mid- and lower Columbia River stretches are reported (Table 6).

Waterfowl Banding

Methods

The use of banding as a tool to derive demographic estimates for survival, harvest distribution and derivation, and harvest rate in Washington has been implemented at varying levels of effort since 1946, with emphasis on mallard (1947) and Canada goose (1949). In March 1990, the Pacific Flyway Council endorsed the Pacific Flyway Study Committee's banding project with the objective of conducting sufficient and representative summer banding to obtain adequate band-recovery data as a necessary element for assessing the distribution and derivation of mallard and other waterfowl harvests in the Pacific Flyway (Bartonek & Bales, 1995). In 1995, the USFWS implemented the adaptive harvest management (AHM) program for setting duck hunting regulations in the United States. The AHM approach provides a framework for making objective decisions in the face of incomplete knowledge concerning waterfowl population dynamics and regulatory impacts (USFWS, 2021a). Since 2010, both the Breeding Population Survey and pre-season mallard banding to inform harvest regulations in Washington (USFWS, 2021b).

Capture of Western Canada geese is conducted during June – July when non-breeding birds and family groups typically undertake flightless molt, allowing the use of a corral trap. A crew consisting of WDFW staff and volunteers is used to herd the flock of flightless geese into a capture pen. Capture of dabbling ducks, with emphasis on mallards, is conducted during July-September using one of three typical methods: 1) baited swim-in trap, 2) baited floating trap, or 3) rocket-net. Configuration of the capture site, accounting for constraints in the surrounding landscape, determine the most appropriate capture technique (Batt, 1992). Each captured individual is assessed, at a minimum, for species, age, and sex, then marked with an appropriately sized aluminum butt-end band issued by the Bird Banding Laboratory and released. Following field efforts, banding data was compiled using Bandit software (BBL: usgs.gov/software/bandit-software).

Results

Pre-season banding efforts were successfully conducted during the summer of 2021 across Washington state in an effort to maintain sample sizes to provide harvest rate estimates for mallard and Western Canada geese for the 2021-2022 waterfowl harvest seasons. A total of 580 goose bands were deployed in western Washington, while banding was canceled in eastern Washington due too extreme daytime heat indexes for the second half of June 2021. The most recent 3-year statewide average for Western Canada goose is 1,062 (range: 842-1,279) goose bands deployed by WDFW staff and volunteers. Due to smaller crew sizes and individual processing logistics, summer (pre-season) duck banding was able to follow social distancing protocols. A statewide total of 1,863 ducks were banded between July and September 2021, with 1,517 being mallard bands. Other species banded during capture efforts included wood ducks, and all three teal species. The previous 3-year average is 1,107 (range: 1,014-1,305) mallard bands deployed by WDFW staff and volunteers.

Potential Improvements to Waterfowl Breeding and Production Surveys

- Provide a visualization tool for breeding survey data available on the WDFW website.
- Develop a standardized operational survey related to productivity, which may be integrated with banding efforts.
- Evaluate ways to combine goose nest and aerial surveys into a more representative goose breeding population index to inform September season harvest strategies.

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Batt, B.D. 1992. The ecology and management of breeding waterfowl. University of Minnesota Press.

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U.S. Fish and Wildlife Service. 2021a. Adaptive Harvest Management: 2022 Hunting Season. U.S. Department of Interior, Washington, D. C. 109 pp. Available online at FWS Adaptive Harvest Management.

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Figure 1. Historic waterfowl breeding survey areas.

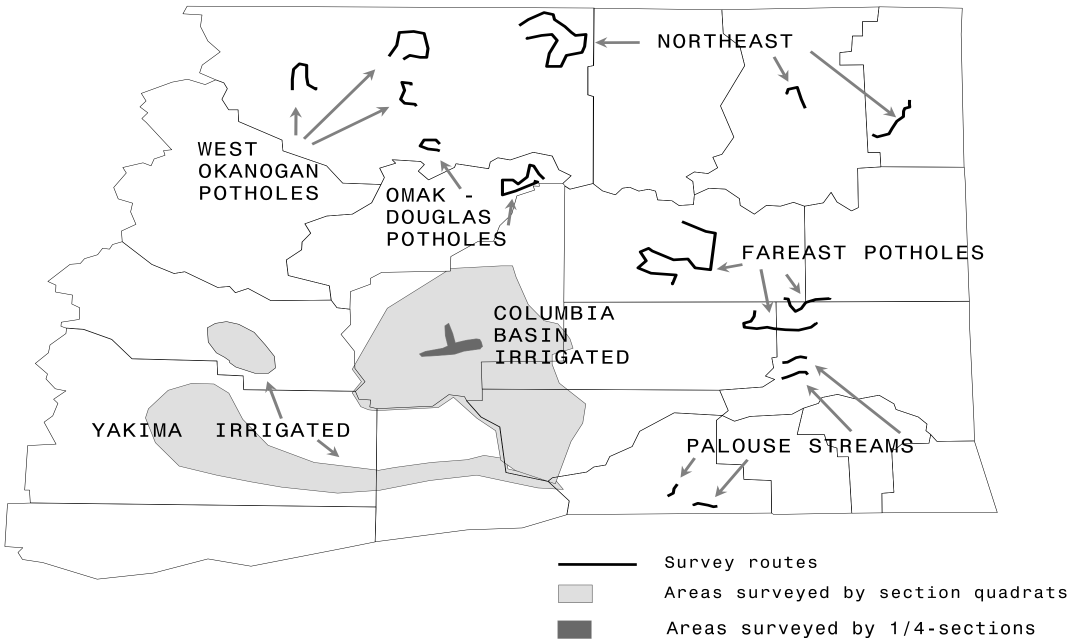

Figure 2. Aerial breeding waterfowl survey transects flown in Eastern Washington.

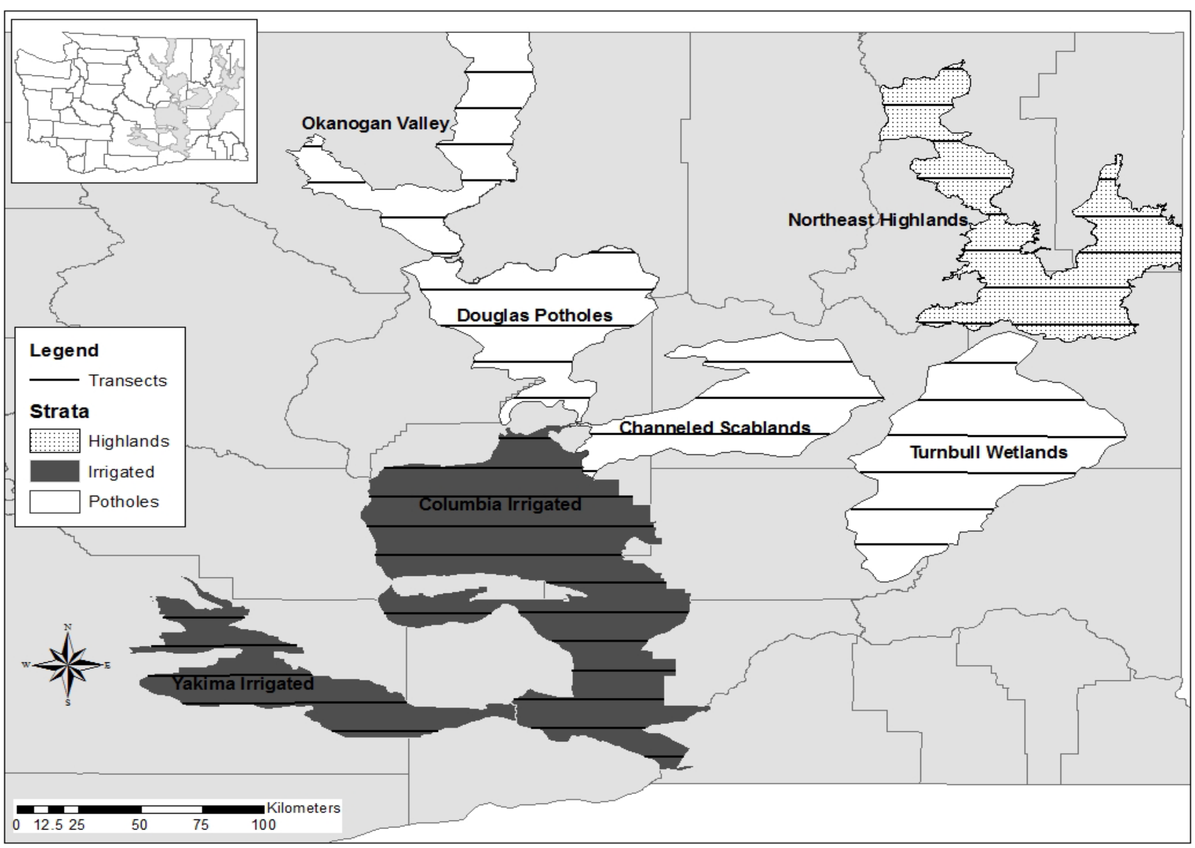

Figure 3. Aerial breeding waterfowl survey transects flown in Western Washington.

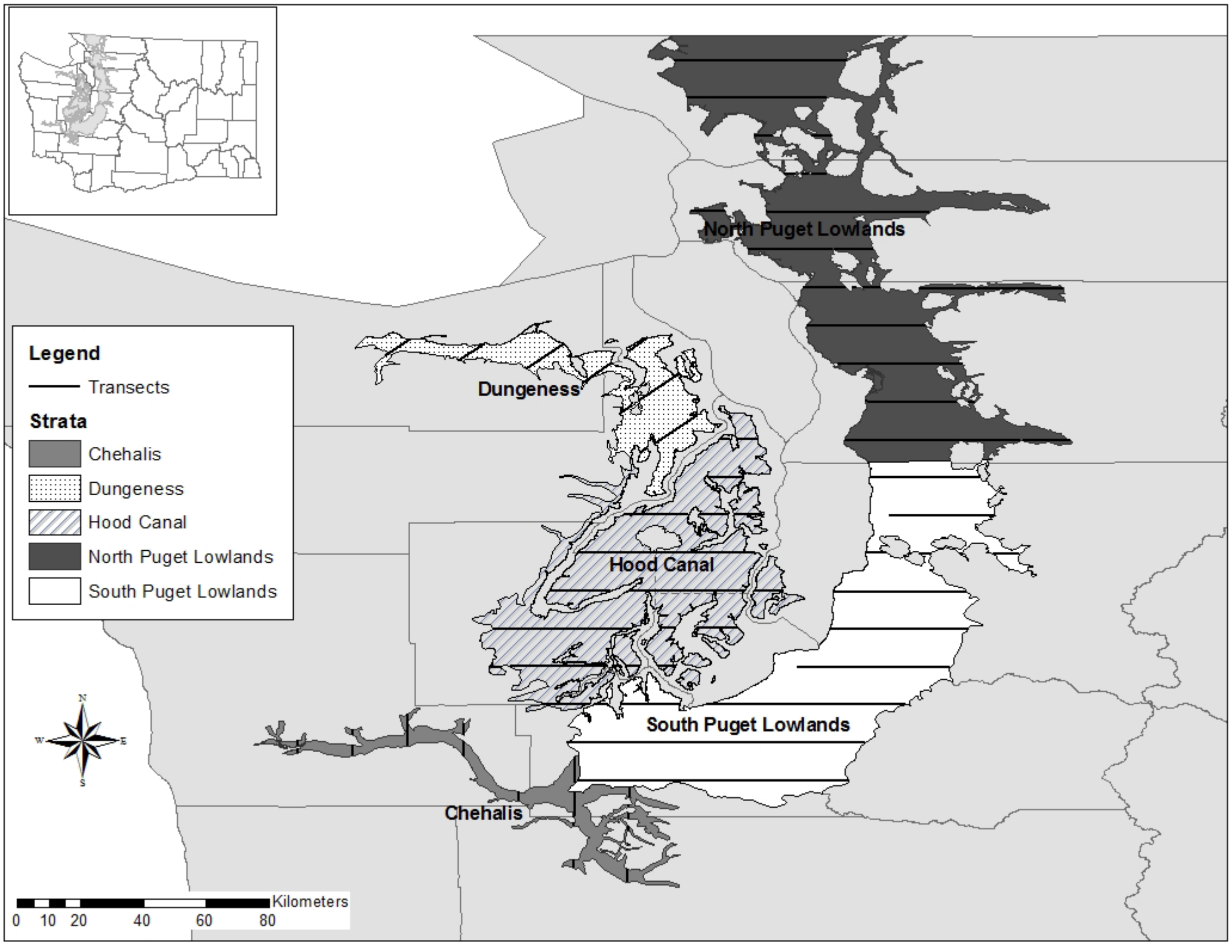

Figure 4. Mallard observation across strata during breeding waterfowl survey in 2022.

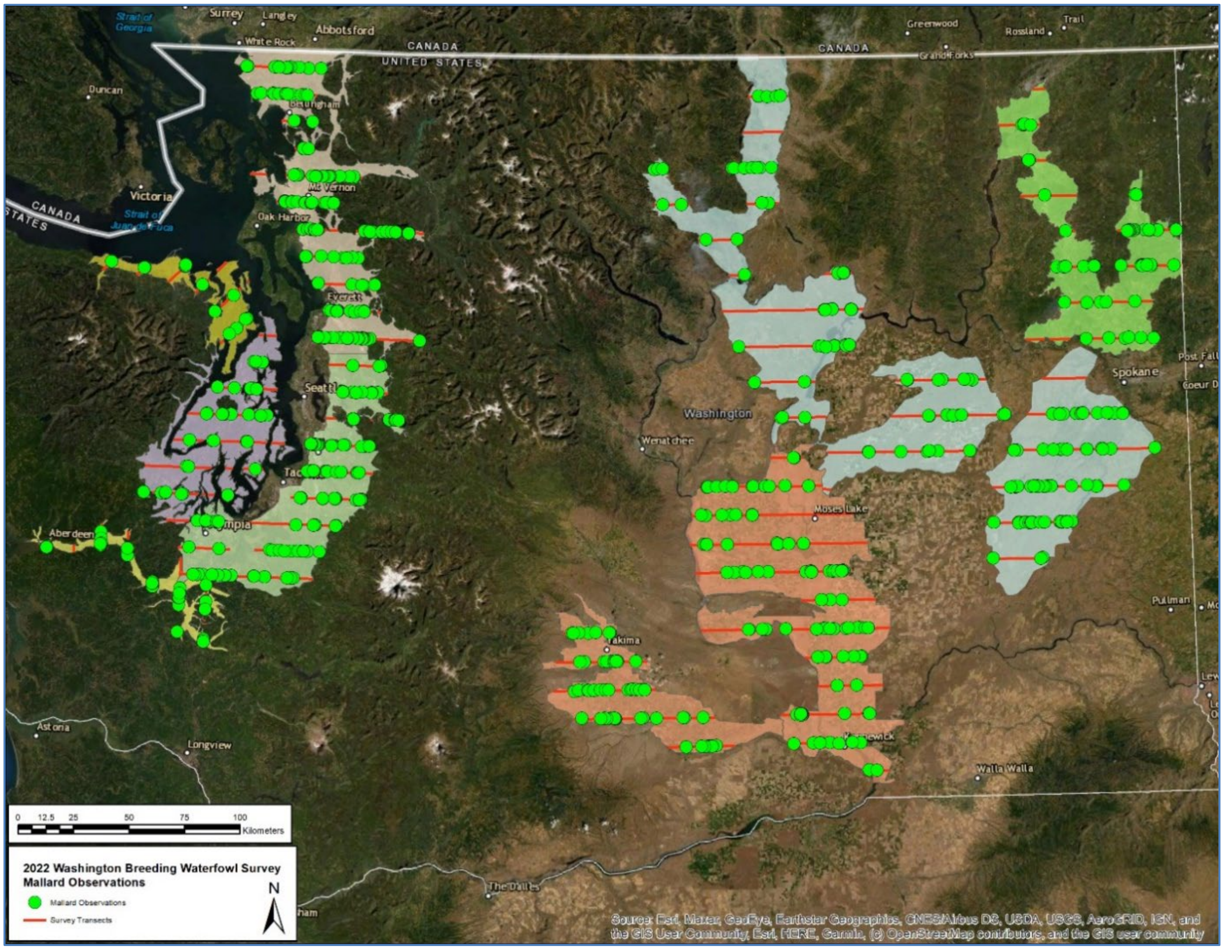

Figure 5. Eastern Washington duck breeding population survey results by species, 2014-2022.

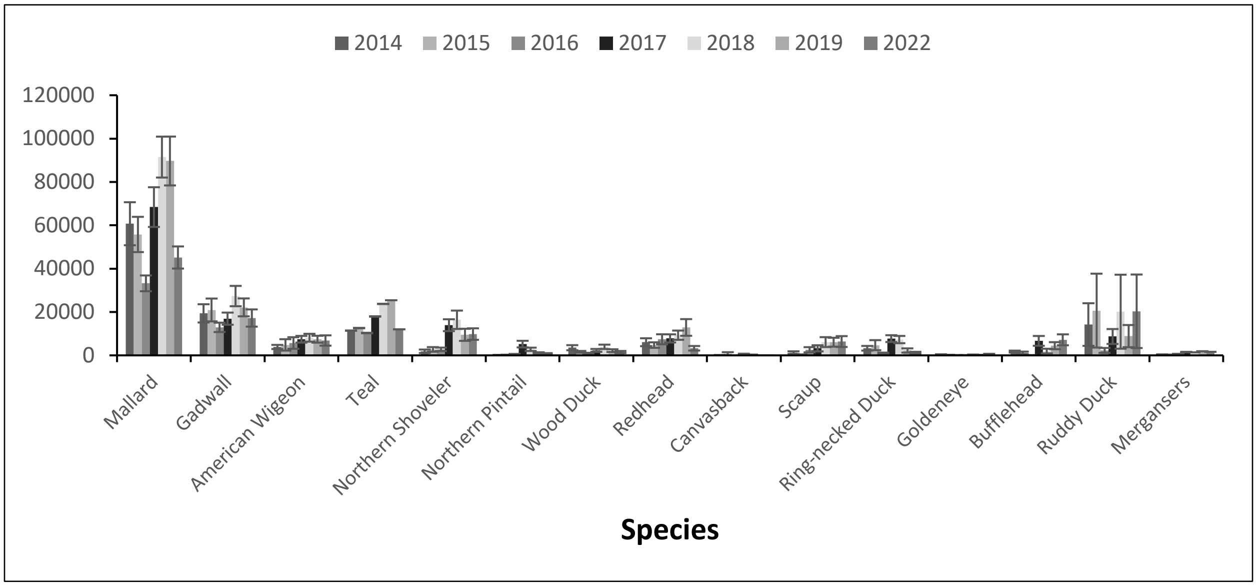

Figure 6. Eastern Washington duck breeding population survey results by species and strata, 2022.

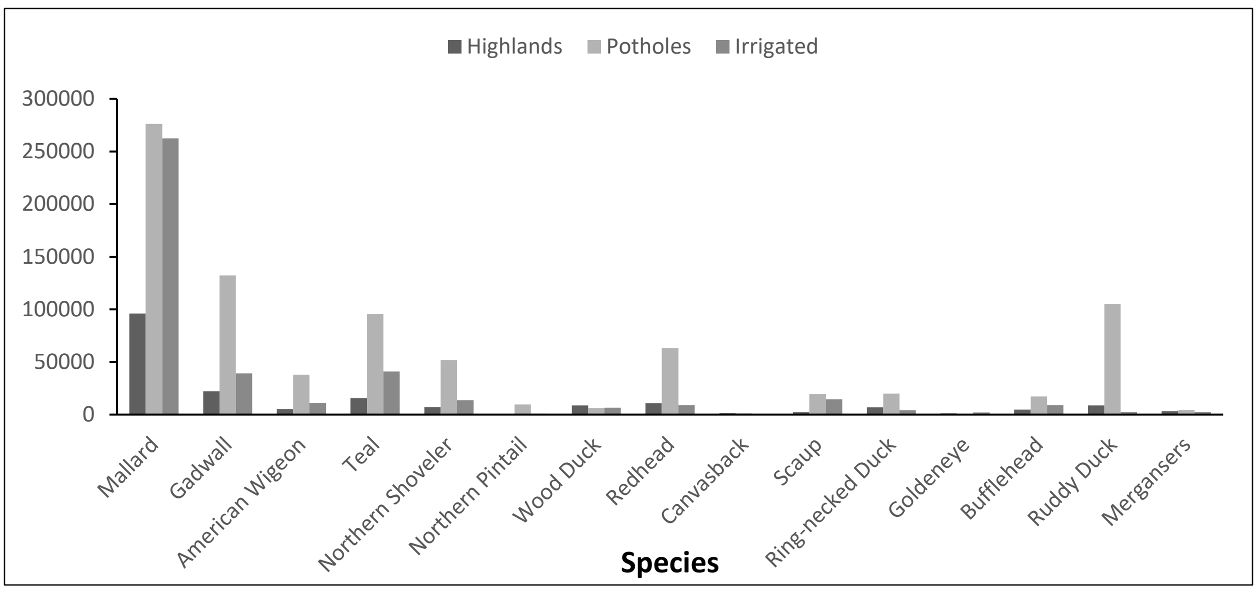

Figure 7. Western Washington duck breeding population survey results by species, 2010-2022.

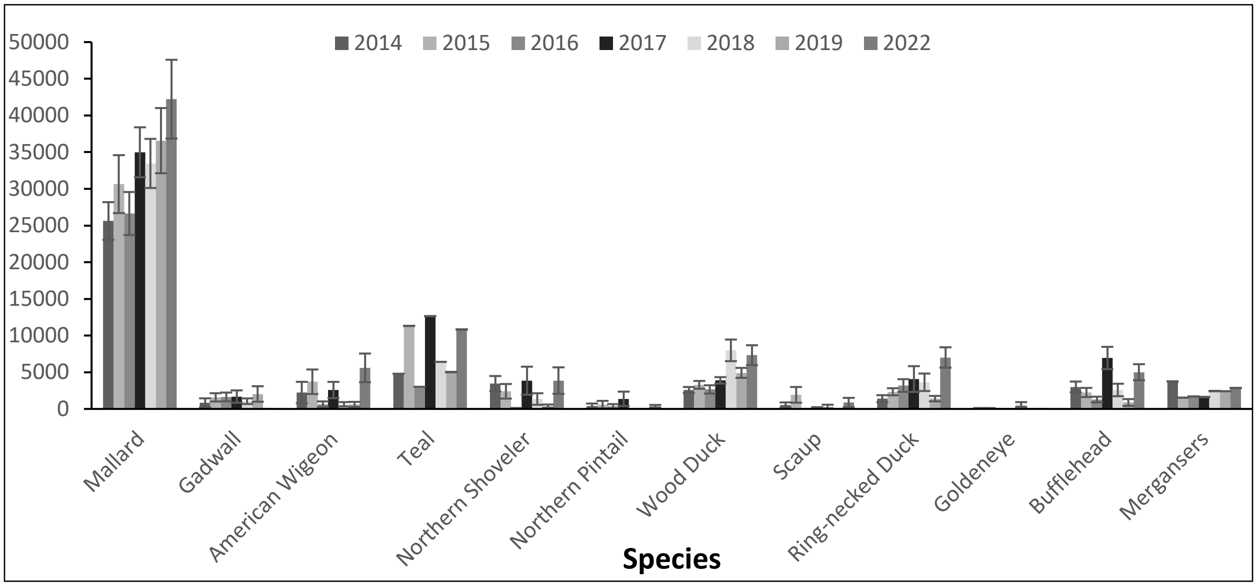

Figure 8. Western Washington duck breeding population survey results by species and strata, 2022.

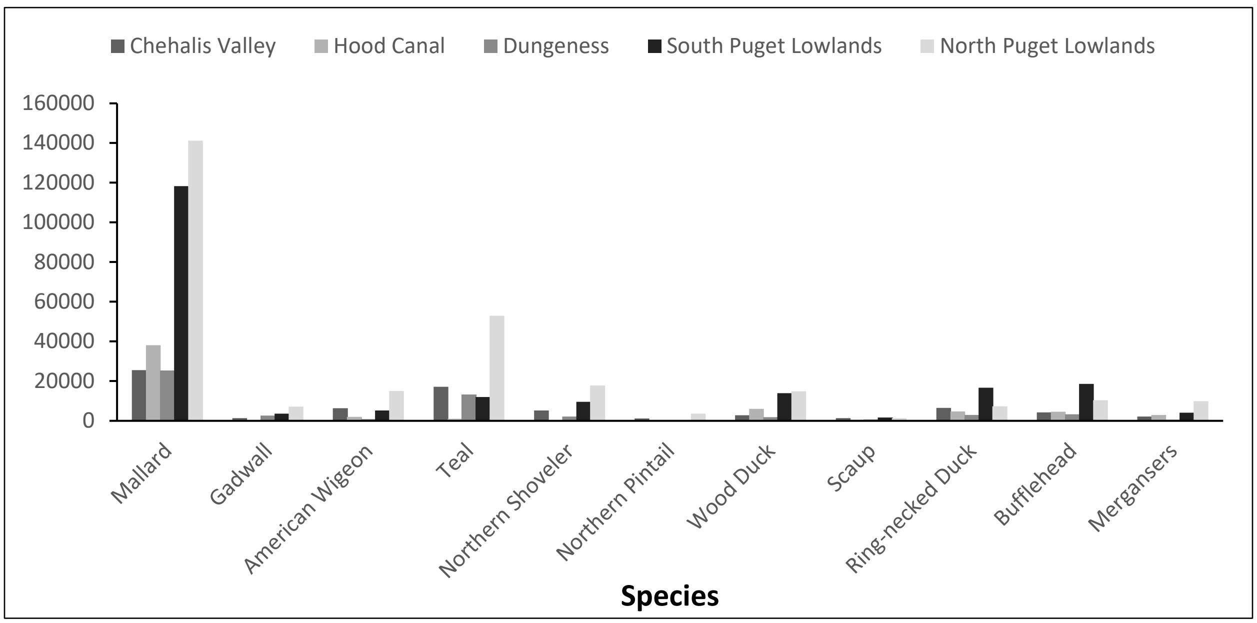

Figure 9. Statewide duck breeding population survey results by species, 2014-2022.

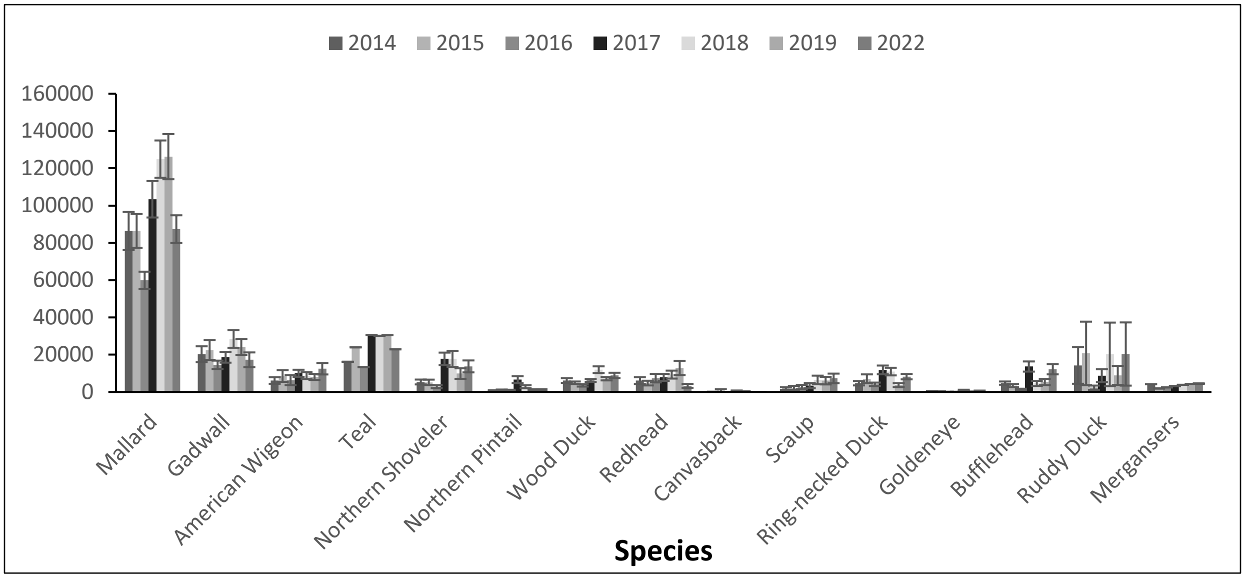

Figure 10. Breeding Canada goose index from breeding duck surveys, 1979-2011 historic, 2010-2022 aerial.

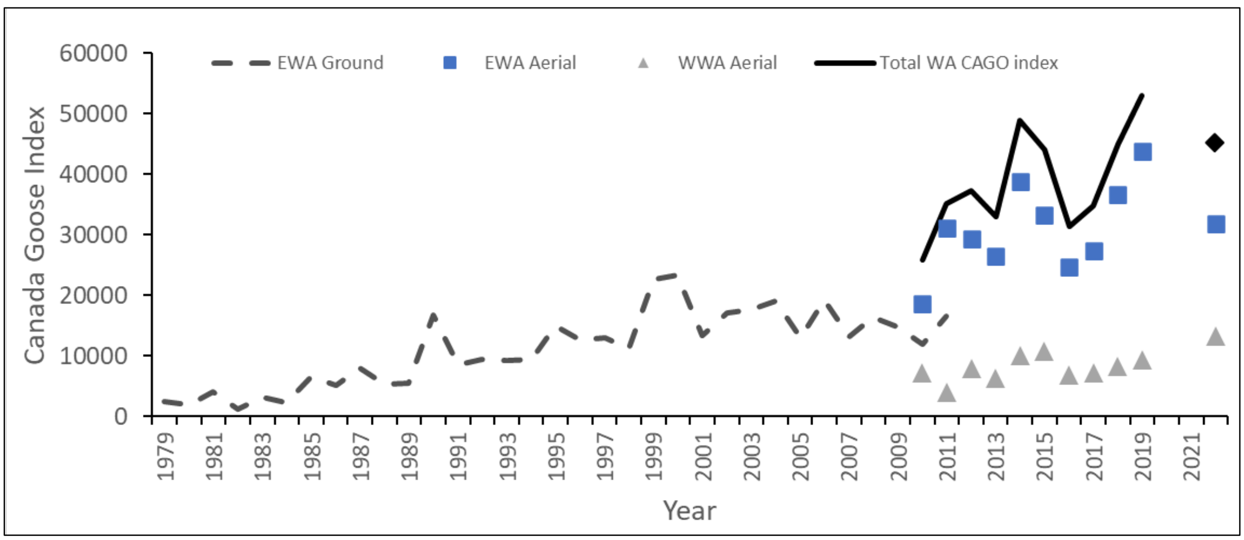

Figure 11. Canada goose observation across strata during breeding waterfowl survey in 2022.

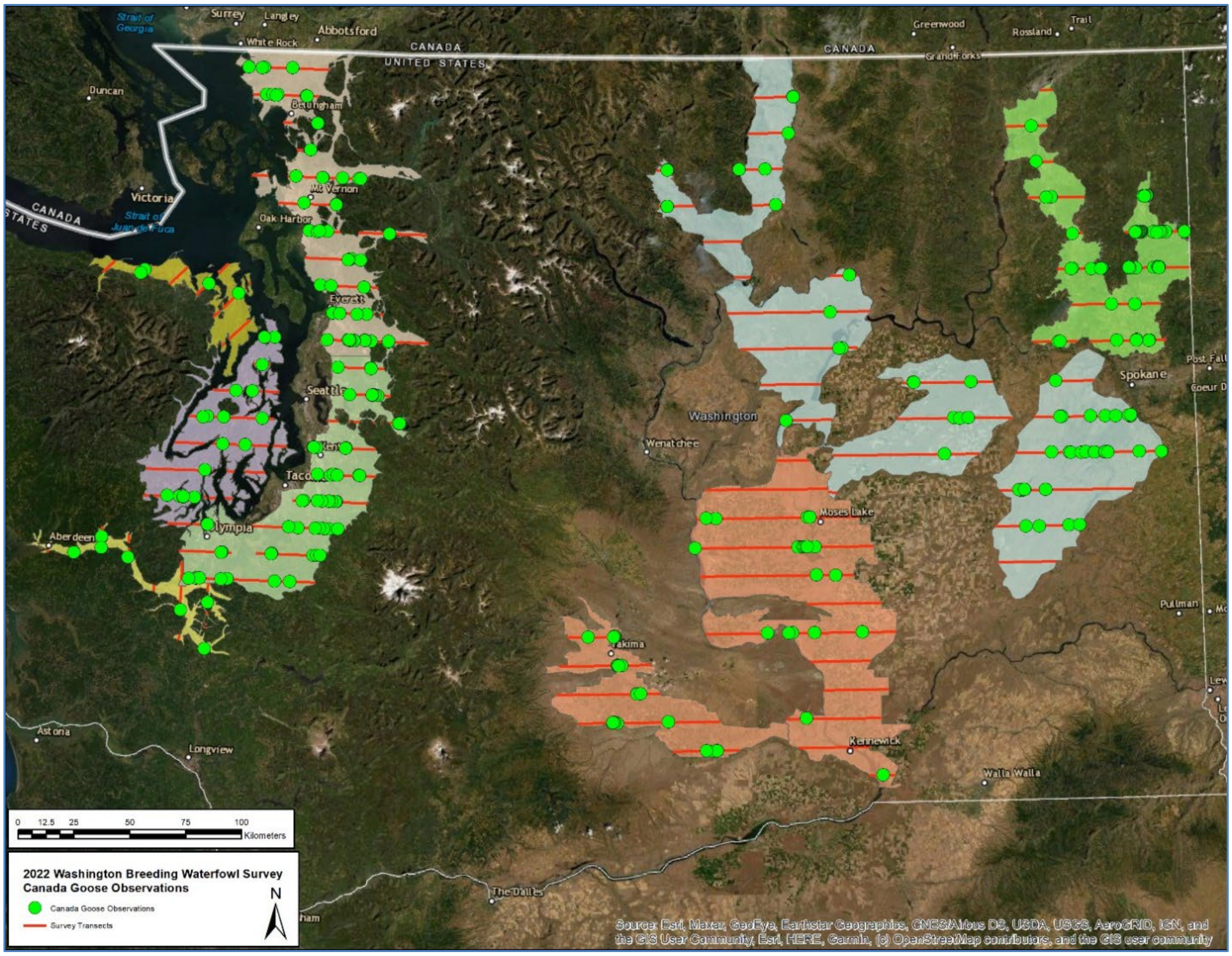

Table 1. Areas and subareas historically surveyed with weighting factors for pond indices, and duck and goose breeding surveys.

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. Summary of eastern Washington breeding waterfowl survey (2010-2022).

		Species																				
Region	**Year**	Mallard	Gadwall	American Wigeon	Green-winged Teal	Cinnamon Teal	Blue-winged Teal	Northern Shoveler	Northern Pintail	Redhead	Canvasback	Scaup	Ring-necked Duck	Goldeneye	Bufflehead	Ruddy Duck	Common Merganser	Hooded Merganser	Wood Duck	**TOTAL DUCKS**	American Coot	Canada Goose
Total - Eastern Washington	2010*	45,667	16,551	1,476	2,957	9,443	1,781	5,950	80	8,816	66	2,206	1,897	80	2,879	2,907	423	0	1,294	**104,473**	14,126	12,474
	±SE	*7,364*	*3,335*	*400*	*770*	*2,663*	*649*	*1,501*	*83*	*1,940*	*52*	*637*	*551*	*86*	*970*	*1,286*	*168*	*0*	*455*	***6,281***	*3,631*	*2,532*
	2011*	*37,679*	*9,909*	*1,456*	*1,981*	*3,004*	*870*	*3,550*	*0*	*4,401*	*262*	*3,238*	*436*	*87*	*1,045*	*7,831*	*521*	*0*	*456*	***76,790***	*9,036*	*22,591*
	±SE	*3,789*	*1,629*	*435*	*649*	*804*	*410*	*862*	*0*	*1,410*	*257*	*1,618*	*217*	*90*	*400*	*4,664*	*235*	*0*	*216*	***6,249***	*2,172*	*4,969*
	2012	56,396	13,829	2,932	820	5,354	1,520	3,496	229	6,798	206	2,316	938	846	2,670	5,770	803	79	2,544	**107,752**	4,693	29,308
	±SE	*5,908*	*2,632*	*988*	*257*	*1,267*	*453*	*701*	*173*	*1,802*	*167*	*758*	*327*	*410*	*898*	*3,571*	*649*	*50*	*754*	***6,493***	*758*	*4,820*
	2013	49,234	15,486	4,027	1,202	7,289	1,634	2,507	0	11,187	406	3,017	507	1,228	976	4,789	229	162	1,089	**105,051**	25,960	26,577
	±SE	*7,065*	*3,273*	*1,539*	*336*	*1,895*	*408*	*771*	*0*	*4,533*	*202*	*977*	*250*	*808*	*352*	*1,767*	*169*	*98*	*270*	***9,127***	*8,922*	*5,870*
	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*
	2022	45,152	17,226	6,859	4,015	8,001	0	9,828	735	3,279	0	6,377	1,182	399	7,175	20,346	1,402	222	1,537	**133,734**	41,533	31,808
	±SE	*5,106*	*3,975*	*2,376*	*1,022*	*1,412*	*0*	*2,648*	*299*	*1,046*	*0*	*2,510*	*452*	*333*	*2,523*	*16,954*	*439*	*173*	*496*	***18,964***	*18,027*	*8,827*

Table 3. Summary of western Washington breeding waterfowl population survey (2010-2022).

		Species																					
Region	**Year**	Mallard	Gadwall	American Wigeon	Green-winged Teal	Cinnamon Teal	Blue-winged Teal	Unclassified Teal	Northern Shoveler	Northern Pintail	Redhead	Canvasback	Scaup	Ring-necked Duck	Goldeneye	Bufflehead	Ruddy Duck	Common Merganser	Hooded Merganser	Wood Duck	**TOTAL DUCKS**	American Coot	Canada Goose
Total - Western Washington	2010	35,526	2,087	4,268	2,981	0	0	10,992	8,029	795	0	0	232	1,159	0	4,763	0	285	0	381	**71,498**	146	7112
	±SE	*2,436*	*710*	*1,421*	*1,353*	*0*	*0*	*5,485*	*2,510*	*351*	*0*	*0*	*163*	*326*	*0*	*655*	*0*	*146*	*0*	*149*	***6,884***	*61*	*3221*
	2011	24,961	1,124	5,010	11,325	60	591	4,397	5,416	0	0	0	126	4,581	0	4,257	0	1,193	188	1,459	**64,688**	180	3969
	±SE	*2,670*	*607*	*2,454*	*4,533*	*55*	*339*	*1,652*	*3,606*	*0*	*0*	*0*	*90*	*1,312*	*0*	*879*	*0*	*524*	*103*	*530*	***7,279***	*96*	*695*
	2012	32,989	1,832	3,223	4,180	0	66	66	2,457	541	0	0	1,110	6,511	0	5,047	0	554	285	2,303	**61,166**	30	7925
	±SE	*4,256*	*933*	*983*	*2,160*	*0*	*67*	*68*	*1,017*	*294*	*0*	*0*	*708*	*1,899*	*0*	*793*	*0*	*266*	*115*	*533*	***5,555***	*28*	*1384*
	2013	24,845	1,169	1,185	6,561	171	155	775	3,866	748	0	0	505	2,968	119	5,075	0	394	302	2,634	**51,470**	158	6394
	±SE	*2,722*	*795*	*632*	*2,182*	*103*	*112*	*501*	*2,130*	*753*	*0*	*0*	*471*	*1,120*	*78*	*889*	*0*	*171*	*148*	*560*	***4,607***	*149*	*1503*
	2014	25,742	828	2,247	4,584	120	0	92	3,470	419	0	0	536	1,398	63	3,015	0	2,956	798	2,603	**48,869**	210	10101
	±SE	*2,604*	*616*	*1,457*	*3,022*	*75*	*0*	*95*	*1,036*	*318*	*0*	*0*	*354*	*478*	*58*	*750*	*0*	*1,961*	*305*	*419*	***4,964***	*117*	*1975*
	2015	30,618	1,581	3,722	9,454	1,420	238	210	2,407	598	0	0	1,944	2,337	60	2,241	30	1,331	211	3,265	**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*
	2022	42,222	0	5,598	10,417	413	0	0	3,865	362	0	0	872	7,014	0	5,002	0	2,124	730	7,328	**85,948**	0	13352
	±SE	*5,368*	*0*	*1,955*	*2,558*	*218*	*0*	*0*	*1,804*	*184*	*0*	*0*	*637*	*1,387*	*0*	*1,098*	*0*	*819*	*242*	*1,356*	***6,972***	*0*	*2509*

Table 4. Weighted duck brood indices by species for the Potholes, Palouse, and Northeast strata, 2004-2020.

																		79-19	% change from	
Species	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Avg**	**2020**	**Average**
Mallard	1284	1221	1200	1786	1419	1416	1035	1042	966	1597	2706	1017	1812	1620	1750	1781	559	1639	-69%	9%
Gadwall	116	15	107	132	292	87	87	379	274	284	204	383	255	281	281	281	76	359	-73%	-22%
Wigeon	95	146	54	54	48	43	10	35	26	26	0	0	26	15	26	15	0	232	-100%	-94%
Green-winged teal	14	26	118	94	151	183	176	233	272	244	204	179	51	190	174	160	51	152	-68%	5%
Blue-winged teal	92	26	15	0	42	48	0	30	47	101	26	51	26	51	51	47	0	493	-100%	-90%
Cinnamon teal	24	40	14	103	91	14	138	30	82	0	13	102	0	39	39	39	102	89	162%	-56%
Northern shoveler	63	0	29	15	59	44	49	19	19	19	0	25	0	12	19	19	0	149	-100%	-87%
Northern pintail	20	0	0	0	0	0	0	0	14	0	0	0	0	14	14	0	0	108	-100%	-100%
Wood duck	42	33	82	107	28	28	42	33	112	141	153	77	255	148	155	158	51	45	-68%	248%
Redhead	40	0	121	211	252	154	94	184	210	205	383	383	204	277	290	307	0	395	-100%	-22%
Canvasback	26	15	65	26	90	0	32	0	77	14	51	51	0	39	39	39	0	33	-100%	19%
Scaup	0	0	20	14	21	94	17	34	0	26	102	76	26	46	55	61	102	46	67%	33%
Ring-necked duck	85	0	108	26	50	14	86	23	14	26	51	77	0	34	38	41	51	47	24%	-13%
Goldeneye	266	163	438	444	412	331	275	391	231	138	332	255	204	232	232	251	76	180	-70%	39%
Bufflehead	0	26	0	40	14	24	43	14	26	179	0	0	0	41	41	14	0	16	-100%	-14%
Scoter	0	0	0	0	0	0	0	0	0	26	0	0	0	26	26	13	0	6	-100%	104%
Ruddy duck	86	110	201	222	219	183	104	86	218	298	332	492	179	304	321	326	179	221	-45%	48%
Merganser	15	0	128	204	77	77	65	56	40	82	102	154	204	116	132	142	26	51	-82%	178%
TOTAL BROODS	3166	1819	4085	3477	3265	2741	2253	2588	2626	3402	4749	3322	3242	3468	3637	3684	1273	4263	-65%	-14%

Table 5. Historic ground-based 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 6. Summary of historic Canada goose nest counts by region (1974-2018) and total Canada geese observed during the aerial breeding surveys (2010-2022). The aerial survey data serves as the statewide index.

Canada Goose Nests								Total Canada Geese observed during aerial breeding population surveys			
Year	Upper Columbia	Snake River	Mid Columbia	Columbia Basin	**EWA Total**	Lower Columbia	**TOTAL Nests**	EWA Ground	EWA Aerial	WWA Aerial	**Total WA CAGO index**
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**	9482			
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	844	**2438**	499	**2937**	19253			
2007	489	217	734	442	**1882**	422	**2304**	13244			
2008	451	197	737	485	**1870**	454	**2324**	16342			
2009	461	243	749	594	**2047**	422	**2469**	14858			
2010	493	241	750	544	**2028**	403	**2431**	12014	18696	7260	**25956**
2011	499	259	725	599	**2082**	415	**2497**	16511	31176	3969	**35145**
2012	462	255	728	628	**2073**	412	**2485**		29308	7925	**37233**
2013	549	199	903	687	**2338**	412	**2750**		26577	6394	**32971**
2014	508	263	814	624	**2209**	376	**2585**		38832	10041	**48873**
2015	593	263	891	762	**2509**	376	**2885**		33347	10770	**44117**
2016	584	263	891	731	**2469**	376	**2845**		24678	6791	**31469**
2017	567	263	833	731	**2394**	376	**2770**		27461	7272	**34733**
2018	567	263	833	717	**2380**	376	**2756**		36662	8331	**44993**
2019									43749	9310	**53059**
2020											
2021											
2022									31808	13352	**45160**
							2022 vs. 2019		-27.3%	43.4%	-14.9%
							Long-term Average		31118	8310	39428
							2022 vs. LTA		2.2%	60.7%	14.5%

Waterfowl: Winter Populations and Harvest Status and Trend Report

STATEWIDE

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Introduction

This report summarizes the 2021-2022 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 the 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 those portions of the MWS in Washington that inform population status or harvest strategies under the guidance of Pacific Flyway management plans, specifically for brant, snow geese, and trumpeter swans associated with the Pacific Coast population.

WDFW also conducts a robust winter survey 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 1993-1994 and have been conducted each subsequent year (except for 2006-2007 and 2017-2018, due to funding limitations, and 2020-2021, due to the COVID-19 pandemic). 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 behavioral reactions of some species to aircraft (e.g., diving, flight).

Midwinter Waterfowl Survey Results

As of 2016, the USFWS discontinued the Pacific Flyway MWS for total waterfowl. Changes in operational priorities for USFWS created the need for states to conduct surveys individually, leaving Washington, Oregon, California, and Montana as the only Pacific Flyway states to conduct portions of these original mid-winter surveys.

WDFW suspended the traditional mid-winter surveys in January 2018, but in western Washington, WDFW staff continue to focus efforts on expanded snow goose, swan, and brant counts. In eastern Washington, WDFW staff conducted the synchronized roost fly-off survey in coordination with ODFW and USFWS refuges for wintering snow geese in the Columbia Basin. For the relative abundance of the various waterfowl species observed during winter in Washington state, the most recent statewide midwinter index for total waterfowl is summarized for 2007-2018 (Table 1).

Ducks – In Washington, the most recent 10-year average for the total wintering duck population was 639,930, but this value does not account for declining survey efforts 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. Traditionally, the Washington total duck count has represented 13.5% of the 10-year average from 2005-2015 in the lower Pacific Flyway. The 1991 MWS represents the highest proportion of Washington ducks to total ducks recorded in the Pacific Flyway (28.6%).

The most recent 10-year average for the total number of mallards counted in Washington was 297,666, which 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 10-year average from 2005-2015 of 41%.

Results for special Puget Sound aerial winter surveys provide status and trend for the eleven species of sea duck that are regularly recorded during these surveys, including (most recent estimate; long-term averages) bufflehead (61,052; 66,042), surf scoter (36,422; 43,897), red-breasted merganser (18,513; 12,986), common goldeneye (15,490; 17,657), white-winged scoter (15,085; 15,707), Barrow's goldeneye (11,258; 12,585), common merganser (5,986; 4,763), long-tailed duck (5,186; 4,910), harlequin duck (3,913; 4,178), hooded merganser (2,047; 1,721), and black scoter (1,602; 1,311) representing the order of species abundance based on the most recent counts (Table 2). The most recent 3-year average for all three species of scoters is 59,982, representing a 20.2% decline in total scoters in the Puget Sound compared to the 2007-2010 average of 73,305.

Canada geese – Canada geese are not well represented in mid-winter 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 1998-1999 and 2000-2001. The most recent 10-year average of total Canada geese is 39,498, but there continues to be high variability in annual counts, which has been driven by decreasing survey efforts (Table 1).

Snow geese – The northernmost flock of lesser snow geese that over-winter across the North Puget Lowland landscape, including Skagit, Snohomish, and Whatcom counties of NW Washington and the Fraser River Delta and Valley British Columbia, Canada nest almost exclusively on Wrangel Island, Russia. Juvenile snow geese comprised a minimum estimate of 16.1% of the wintering population in the Fraser and Skagit River Deltas when assessed in March 2022; however, this estimate is biased-low as it was after the harvest season concluded. The MWS snow goose aerial photo counts by WDFW were conducted on March 4, 2022, with a total estimate of 120,725 (3,019 SE), representing a 9.4% decrease compared to the 2020 estimate (2021 survey canceled due to COVID-19 protocol) of 133,306 counted in December 2020. This represents the second-highest winter count recorded for this flock, with the most recent 3-year average for adult geese of 93,979, remaining above the upper threshold identified by the Pacific Flyway management plan (Table 3, Fig. 1). Reports from the Wrangel Island Tundra River colony indicated exceptional above-average juvenile recruitment and survival in 2019 through 2021. It is not yet clear for 2022 as indications were that while the breeding colony size (number of nests) was higher, the average clutch size was significantly lower than in the recent three high-young years.

2022 was the fifth year of a coordinated effort to document the growing number of wintering snow geese in the Columbia Basin in both Oregon and Washington. The Columbia Basin Snow Goose Fly-off Survey is a synchronized roost fly-off assumed to be a minimum count. This survey was conducted on December 16, 2021, with a minimum count of 119,771 white geese, presumed to be almost exclusively lesser snow geese. The count represents a lower minimum count than December 2020 (153,690) and well below the peak minimum count recorded in December 2019 (160,825). Both winter flock counts were lower than previous winter counts; however, coverage in the Columbia Basin winter flock has become difficult to assess from roost fly-off counts accurately. Additionally, counts from the Lower Columbia River conducted by the Oregon Department of Fish and Wildlife indicated a minimum count of 35,748, which would be the highest on record for this growing third-winter flock region. The winter distribution of lesser snow geese in these regions is undoubtedly being driven by the rapid increase in the population size from favorable conditions on the breeding grounds of Wrangel Island, as well as changing land use and crop types providing expanded available foraging opportunities in these regions.

Brant – The preliminary number of brant counted in 2021-2022 during the Washington portion of the Pacific Flyway Winter Brant Survey was 10,390, a 4.3% increase from 2020-2021, but 27.2% below the long-term average (14,269; Table 1, Fig. 2). The number of brant counted at Willapa Bay during the ground-based winter survey was 3,944, an increase of 52.5% from 2020-2021. The number of brant counted during the northern Puget Sound component (Skagit County) of the aerial survey on January 5, 2022, was 2,750, which was 19.8% below the 2020-2021 count. The 2022 survey recorded the second count below 3,000 brant in the past three years, and results in a recent 3-year average of 2,924, which is below the 3,000 brant closure threshold for Skagit County brant harvest. 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%, requiring a more restrictive harvest management strategy, as defined by the Pacific Flyway management plan for the population. Since opening in 2018, hunter bag checks in Clallam County have assessed 148 brant, with nine brant classified as WHA (6%), falling below the threshold considered a WHA-site (>25% WHA in harvest). In Whatcom County, WHA status remains difficult to assess; however, in 2020-21, WDFW staff implemented a photo submission request that generated 37 photo submissions of 20 unique individual brant, and a preliminary estimate of

15% (3 of 20) WHA in harvest, below the 25% threshold. Assessment of WHA status in Whatcom County will continue to be a priority.

Swans – The 2021-2022 northern Puget Sound (Skagit, Whatcom, Snohomish, King, and Island counties) trumpeter swan MWS totaled 14,425 (Table 3), a 15.6% increase from the 2020-2021 count of 12,475, but observers could not speciate additional swans due to distance from the swans. Juveniles accounted for 13.6% of the trumpeter swans observed (Table 3). An additional 164 trumpeter swans, including 31 juveniles (18.9%), were counted in Clallam County.

The 2021-2022 northern Puget Sound tundra swan midwinter index was 523, 25.4% below the 2020-2021 index (701). Juveniles represented 7.6% (40), down from 10.4% of the population in 2020-2021 (Table 3). A total of 2,974 adult swans and 332 juvenile swans could not be classified to species in these northern Puget Sound counties.

An expanded winter swan effort was conducted throughout western Washington, recording a minimum presence of 22,870 total swans, with detection in every western Washington county; however, reliable speciation could not be determined in certain counties due to distance from the observer. However, the minimum winter count for trumpeter swans recorded was 15,696 and reaffirms that the primary concentrations are in northern Puget Sound region and the Lower Columbia River region, where species composition is assumed to be a higher mix of tundra and trumpeter swans.

Since 1999, trumpeter swans and, to a lesser degree, tundra swans wintering in northwestern Washington and southwestern British Columbia have experienced documented 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 were 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 three winters (an average of 67 lead-related mortalities in 2006-2009) when compared to the average of 227 lead-related mortalities per year over the previous five years (2001-2006).

Starting in 2009, hazing at Judson Lake focused on the area with the highest lead shot concentration. Bamboo poles and fencing prevented swans from landing in the exclusion area while allowing them the 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 2014-2015, with 203 (54%) showing signs of lead poisoning. This prompted a revamping of the exclusion area in November 2016. Winter 2020-2021 represented the fourth-year post-revamp of the exclusion area related to monitoring efforts and resulted in 500 encountered mortalities in the long-term monitoring region (including Sumas Prairie, BC; n=480) and other counties (n=20), of which 208 (43%) were confirmed lead poisoning, but with 167 (35%) undetermined-cause mortalities, bringing the total confirmed lead mortality to 2,696 swans. Evaluation of the logistics (longevity, practicality, and alternatives) of the exclusion zone given the past three seasons of elevated encounters have corresponded with lake levels that preclude pre-season access to the site. Given the increased number of responses, in June 2021, a complete revamp of Judson Lake was completed by WDFW staff, with bamboo poles supplied by partners with the Canadian Wildlife Service. Following the complete revamp of the Judson Lake enclosure in June 2021, the winter 2021-2022 efforts resulted in 166 mortalities, 39 lead poisoning, 61 powerlines, 14 feather piles, and 48 non-determination, a significant reduction in Judson Lake-related mortalities. Monitoring of mortality cause and source of lead exposure in gizzard and liver samples will continue to be documented and spatial extent mapped.

Periodic Aerial Survey Results

Without USFWS assistance, it is not logistically feasible to maintain the periodic aerial survey flights for the northern Puget Sound, Willapa Bay, and eastern Washington (Columbia Basin and Yakima Basin)., and therefore these surveys have lost contextual relevance on the landscape. Emphasis was again placed on training observers and to focus efforts on the PSAMP winter sea duck survey flights and species with Pacific Flyway Management Plan monitoring requirements. The WDFW Waterfowl Section will continue to evaluate the potential of periodic aerial surveys when logistics allow and where resource concern influences prioritization of monitoring efforts.

Hunting Season Regulations

The 2021-2022 waterfowl harvest was regulated under Washington State regulations following federal framework recommendations (Table 4). The federal framework allowed the maximum number of days (107 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 September 25 in western Washington and October 2 in eastern Washington, and a statewide Youth, Veteran, and Active Military Hunt held Saturday, February 5, 2022. The daily bag limit was seven ducks, to include not more than two hen mallard, one pintail, two scaup, two canvasback, and two redhead statewide; and to include not more than one harlequin (season limit), two scoter, two long-tailed duck, and two goldeneye in western Washington (Table 4).

Relatively stable and robust waterfowl populations in the Pacific Flyway over the last 25 years have allowed for liberal seasons and bag limits (Table 5). The season lengths between 1988-1989 and 1993-1994 were the most restrictive since 1950. Current regulations are among the most liberal ever offered in Washington. Beginning with the 2014-2015 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 1999-2000 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 2002-2003 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 2009-2010 and 2010-2011. The physical stamp validation was replaced with a printed migratory bird permit in 2011, and the cost was $15.00 in 2011 before administrative costs were approved to be included in the cost raising it to $17.00 in 2012 and has remained through the current season. Beginning in 2011-2012, 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 certain regionally-predictable Canada goose subspecies, increase recreational opportunities on expanding populations of Canada geese, simplify regulations, and address damage/nuisance complaints through the prioritization of regulated harvest. The number of goose management areas became six during 2019-2020, with Area 2 being divided into Coast and Inland zones to allow for differential seasons dates to accommodate differences in distribution and opportunity related to Cackling goose subspecies. However, Goose Management Area 2 (GMA2) continues to prioritize the conservation of Dusky Canada geese (Fig. 3). Additionally, this zone adjustment required SW Canada Goose hunters to record the number of geese taken on the mandatory harvest report card to provide a more accurate estimation of harvest in this diverse opportunity goose zone and to emphasize identification and avoidance of Dusky Canada geese most prevalent in this region.

Prior to 1984, the goose season length in southwest Washington was 93 days, with bag/possession limits of 3/6. Since then, 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 2015-2016 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 from 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. Historic season regulations for SW Washington are presented in Table 6. A special late-season addressing agricultural depredation concerns initiated in 1995-1996 was continued in what was then referred to as Area 2A and initiated in Area 2B during 2015-2016. Beginning in 2016-2017, Area 2A and 2B were combined into GMA2. Since 2018-2019, Goose Management Area 2 has been 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). Season structures and specific dates are summarized in Table 4.

Beginning with the 2015-2016 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 are set at 15 and 45, respectively, for the Coast zone 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 are available through the Private Lands Feel Free to Hunt or Register to Hunt programs, but these lands accommodate all waterfowl hunting opportunities and were renamed the Waterfowl Habitat and Access Program prior to the 2021-2022 season. Numerous public safety concern complaints 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. These same restrictions were extended to include Whatcom County, as it was incorporated into the boundary of Goose Management Area 1 during the 2021-2022 season (Fig. 3). Violation of these rules, trespass, exceeding the snow goose bag limit, or shooting across a paved road resulted in the 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 2022, with 14 hunt days in Pacific County, three days in Clallam and Whatcom Counties, and a restricted 2-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 restricted-day season, or more than 6,000 brant, allowing an 8-day season. Piloted during the 2019-20 season in Skagit County, the previous 3-year average was used to determine if a "known" opening weekend was warranted. The results of the aerial survey informed a potential expanded opportunity. In January 2022, the Skagit County aerial direct count estimated 2,750 brant. This triggered a restricted 2-day season in Skagit County (the "known" dates) that aligned the two Saturdays with the dates of Clallam and Whatcom County in order to space the dates to account for potential uncertainties with weather and tide.

Harvest Surveys

Methods

Harvest estimates were traditionally based on the Small Game Harvest Questionnaire sent to 10% of the hunting license buyers. Hunters were asked to report the number of ducks and geese they harvested by county. Prior to 2017, 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 four biologists (four WDFW staff in February 2022) 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 data also provides data at the county-level but 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 the harvest of several priority waterfowl species, special surveys have been developed that utilize written hunting authorizations and mandatory reporting. The sea duck (scoters, goldeneyes, long-tailed duck, and harlequin duck), brant (four open counties), and snow goose (in northwest Washington) harvest are estimated annually using a mandatory harvest report card for each species group. Written authorization and harvest reports have been required of sea duck hunters in all western Washington counties since 2004, brant hunters in all hunt areas since 1990, snow goose hunters in the primary harvest area (Skagit, Island, Snohomish counties) since 1993, and Goose Management Area 2 Coast and Inland (Clark, Cowlitz, Wahkiakum, Pacific, and Grays Harbor counties closed to dusky Canada goose harvest that require an identification test and authorization) since 2018. Hunters must return a harvest report card in order to be included in the permit mailing the following year. Starting in 2012-2013, 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 respondents 'first wave'. 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 20th following each waterfowl season.

The harvest of dusky Canada was closed beginning with the 2015-2016 season in Goose Management Area 2 from October through March (see above) in agreement and coordination with ODFW and USFWS. With the removal of check stations, law enforcement checked hunter bags in Goose Management Area 2 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 Goose Management 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 2007-2008, 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 2017-2018 season, the online test was modified to make it easier for hunters to purchase their license upon successfully passing the identification test. Suppose a hunter takes a dusky Canada goose or does not comply with field check requirements. In that case, 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 2021-2022 Washington duck harvest of 402,158 decreased by 5.6% compared to the 2020-2021 harvest of 426,092, which was the lowest since the 2004-2005 season. The duck harvest in Washington declined steadily from over 1,000,000 in the late 1960s to a low of 242,516 in 1993-1994 (Fig. 4). However, duck harvest rates in Washington have stabilized over the past ten years, averaging approximately 434,774 ducks annually.

Based on 2021-2022 results from the Pacific Flyway Wingbee (Parts Collection Survey), mallards comprised 45.2% of Washington's statewide duck harvest, followed by American wigeon (21.3%), American green-winged teal (9.9%), and northern pintail (5.4%), cumulatively accounting for 81.8% of total duck harvest, with 23 other species of duck constituting the remaining 18.2% of harvest (Table 7).

A total goose harvest (excluding brant) was estimated at 77,847 geese, with a composition of 52,639 (62.8%) Canada and cackling geese, 24,812 (36.6%) white geese (including lesser snow and Ross' geese), and 396 (<1%) greater white-fronted geese. The total Canada goose harvest for 2021-2022 was 44,601 during the regular season, with an additional 8,038 Canada geese taken during the September season, an increase of 3.7% compared to the 2020-2021 September Canada goose season and the third consecutive year of increase. The 2020-2021 goose harvest estimates set new records compared to the previous high 2017-2018 goose harvest estimates of 83,492, of which 75,782 total geese were taken during the regular season, but 2021-2022 set a new high for the September Canada goose season. A record low harvest of 26,479 occurred in 2004-2005. During recent years, Washington's breeding segment of Western Canada geese has increased across Washington, which has contributed to an overall increasing trend in harvest (Fig. 5), but the total goose harvest increase has been driven by the rapid increase in statewide white goose harvest as bag-limits have become more liberalized in response to an increase in the Wrangel Island population of lesser snow geese. Washington's statewide goose harvest has averaged 75,487 geese annually over the past ten years.

The estimated harvest of cackling geese (formerly, small Canada geese including Taverner's, Aleutian, and "minima or cacklers" subspecies) in 2021-2022 (14,936) is consistent with the most recent long-term average (Fig. 5). The highest recorded harvest of small Canada geese in Washington was 47,270 in 1979-80, while the lowest harvest (8,880) took place in 2003-2004. The reasons for the dynamic small Canada goose harvest are uncertain, but concerns continue related to the complex of lesser Canada goose and Taverner's cackling goose, particularly in the Columbia Basin (Goose Management Area 4).

WDFW administrative regions in Table 8 summarize waterfowl harvest. Region 2 traditionally represents the highest percentage of the state's waterfowl harvest. However, during the 2021-2022 season, Region 4 accounted for 28.2% of the total waterfowl harvest, followed by Region 2 (22.5%) and Region 3 (20.2%). The proportion of duck harvest was highest in Region 4 (29.3%), followed by Regions 2 (20.8%) and 3 (20.7%). Region 2 continued to account for the highest proportion of goose harvest (31.7%), followed by Region 4 (22.8%), and Region 1 (18.3%); however, Region 4 accounted for the highest proportion of September Canada goose harvest (30.9%).

Mandatory Harvest Reporting Results

Restrictive bag limits for most sea ducks were maintained for western Washington in 2021-2022. 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 2,024 sea ducks representing a 12.8% increase from the 2020-2021 season. Notably, the number of hunter days was estimated at 2,329 days afield, which would be the second-highest estimate since mandatory harvest reporting began in the 2004-2005 season. Based on compliant and non-compliant harvest report components, biologists estimated species composition as 1,046 scoters, 160 long-tailed ducks, 297 harlequin ducks, and 521 goldeneyes (Table 9). The reported goldeneye harvest included 59.7% Barrow's goldeneye. Primary sea duck harvest areas included Island (33.8%), San Juan (18.2), Whatcom (12.0%), and Mason (11.9%) counties.

The 2021-2022 pre-season count of brant in Padilla/Samish/Fidalgo Bays was below the threshold of 6,000 and below the 3,000-closure threshold, allowing a 2-day January brant season in Skagit County. The previous 3-year average of 3,742 was used to provide two "known" Saturday hunt dates, but the results of the pre-season survey of 2,750 brant allowed for no additional days. The two Saturday hunt dates were the same as the open dates of Clallam and Whatcom County in an effort to disperse hunter days afield. An estimated 1,042 brant were harvested from the four counties statewide during the 2021-2022 brant season, a 56.5% increase over the 2020-2021 brant season. This statewide harvest estimate included the February 5, 2022, Youth, Veterans, and Active Military Personnel (YVMP) special hunt date that included brant as a legal species. Skagit County brant harvest was estimated at 561 brant, 90.2% over the 2020-2021 (a 3-day restricted, plus YVMP special hunt date) season estimate. Brant hunting was maintained as a 14-day season in Pacific County, resulting in an estimated harvest of brant was 126, 18.9% above the 2020-2021 estimate of 106 (Table 10). Additionally, for the fifth consecutive year, harvest was allowed in Whatcom and Clallam counties resulting in 124 and 180 brant harvested, new records for both counties, respectively. These two counties opened in 2017-2018 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 2020-2021 snow goose harvest in Goose Management Area 1 was estimated at 6,590, a 25.8% increase from the 2020-2021 harvest of 5,240 (corrected for non-compliance). Snow goose harvest in Washington is historically variable (Table 11) 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 a greater harvest. This factor, as well as the proportion of juveniles, may be of greater importance to harvest than total abundance because the erratic annual harvest does not follow the number of geese counted in Washington during the MWS (Fig.1). These geese have recently expanded their wintering range in northwestern Washington to portions of Whatcom, 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. Recent changes to the bag-limit configurations for goose seasons, including season dates into February-March in Goose Management Areas 1 and 4, have resulted in significant increases in total white geese (lesser snow and Ross' geese) in the statewide harvest, evident by these geese now accounting for 24,812 (36.6%) of the total goose harvest in Washington (Table 7).

In the southwest Washington goose season, hunters who passed the identification test in 1996-2020 and did not take a dusky Canada goose in 2020-2021 were authorized to hunt in 2021-2022. New hunters and those that illegally harvested a dusky in 2020-2021 were required to take a new test to obtain authorization. Beginning in the 2019-2020 seasons, goose hunters in Goose Management Area 2 were required to record harvest of Canada and cackling geese to generate a better harvest estimate from these five counties. A combination of uniformed and undercover officers documented hunter compliance through individual field checks throughout the regular and late seasons. Additionally, biological staff has conducted field checks to determine subspecies composition in the reported harvest, as reliable identification requires measurements and would not be feasible to ask of hunters. An estimated 2,092 Canada and cackling geese were harvested in Goose Management Area 2, by 971 hunters accounting for 2,734 days afield. Of 244 geese classified during bag checks (Table 12), one dusky Canada goose was recorded. The number and species of geese brought to check stations from 1969-2015 varied annually, but the presence of "minima" cackling geese is an important component of the composition, typically accounting for greater than 60% of the total harvest composition.

Hunter Numbers and Success

The Washington small game hunter survey was used to estimate the number of waterfowl hunters in the state. During the 2021-2022 season, an estimated 22,256 duck hunters, down 9.3%, and 11,039 goose hunters, down 7.6%, participated in the Washington waterfowl season (Fig. 6), accounting for an estimated 163,289 (down 18.2%) days afield for duck hunting and 57,825 (down 25.4%), with an additional 6,344 (up 9.9%) September goose days afield for goose hunting. The 2020-2021 waterfowl season recorded significant single-season increases largely attributed to increased participation in waterfowl hunting during the COVID-19 pandemic. Following a steep decline in 2002, there had been a stable-to-slightly-decreasing number for approximately fifteen years, although waterfowl stamp and permit sales have been stable, if not increasing, since the early 1990s. Prior to that, there was a steady decline in hunters through the 1980s (Fig. 6).

The estimated average number of ducks harvested per hunter in 2020-2021 was 18.1, a slight increase compared to the 2020-2021 season, even with significant decreases in duck harvest, hunters, and days. In contrast to recent depressed hunter numbers, hunter success, when defined as ducks harvested per hunter per year, has been on an upward trend since the mid-1990s (Fig. 7). This suggests that the downward trend in total duck harvest (Fig. 4) is more related to hunter numbers (Fig. 6) than decreased annual hunter success. The high success rate, relative to other states nationwide, 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 or are failing to recruit new waterfowl hunters due to perceived or real competition in the field. 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. 6), 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 days in the west zone and 100 days in the east zone (Table 5), and since diverged from waterfowl population status which improved to recorded highs during 2015-2016. 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, when defined by the average harvest per hunter of waterfowl hunting opportunities in Washington is fair to excellent for the majority of the season and is largely driven by winter weather patterns in relation to water and forage availability (bioenergetic supply) 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 overall success has remained stable to increasing. In addition, the state holds 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 not only from an access and opportunity perspective but the standpoint of meeting energetic requirements of species that depend on different regions of the state during the nonbreeding period. 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 in "quality" hunting opportunities found in public hunting areas. In response, WDFW has developed initiatives to address public hunting opportunities on public and private lands. In 2018-2019 there were six 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. In April 2021, the Fish and Wildlife Commission adopted regulations that expanded the number of Waterfowl RAAs to ten. WDFW also continued the private land access program, now 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 Region's 2, 3, 4, and 6. Some of these programs featured limited access designed to reduce hunter crowding and 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. Finally, there is acknowledgment, but not widespread acceptance, that waterfowl hunters define "quality" very differently dependent upon which of the five (or six) stages of hunter development one affiliates themselves with as to the characteristics of "quality" that they desire. Understanding these differences would help guide efforts and efficiencies on the ground to target more equitable access to opportunities.

Washington Banded Waterfowl Harvest Recoveries

During 2021-2022 a total of 458 harvested band recoveries for mallards banded in Washington, with 397 (86.7%) recovered in Washington state (Figure 8). Reported Washington mallard harvest encounters occurred in October (123; 26.9%), November (79; 17.2%), December (116; 25.3%), and January (138; 30.1%), with the other two harvested during special hunt dates: one during September, and one during February. During the 2021-2022 goose season, a total of 237 harvested band recoveries were reported for Western Canada geese banded in Washington, with 195 (82.3%) recovered in Washington state (Figure 9). Reported Washington Western Canada harvest encounters occurred in September (62; 26.2%), October (25; 10.5%), November (24; 10.1%), December (43; 18.1%), January (75; 31.6%) and eight reported during limited late-season segments in February and March.

Recommendations

- Attempt to minimize harvest regulation adjustments during the final year of the three-year period and continue to evaluate harvest opportunities and access limitations.
- Evaluate trends in sea duck harvest, particularly the significant increase in harvest days afield.
- Re-evaluate harvest strategy in both sea ducks and brant in preparation for the update to the waterfowl portion of the WDFW Game Management Plan.
- Prioritize winter brant survey count of Whatcom and derive estimates from the two previous seasons using available PSAMP data (evaluate years with overlap for comparability).
- Continue the Columbia Basin Snow Goose Fly-off Survey in coordination with ODFW.
- Initiate a collaborative effort to investigate the concerns around the “small Canada goose” complex of Taverner’s cackling geese and lesser Canada geese, involving USFWS, ADFG, and Pacific Flyway partners.
- Derive harvest rate estimates for Washington breeding mallards and provide a comparison against expected values derived for the Western Mallard AHM model.
- Provide a more detailed summary of mallard and Canada goose band returns in future reports, including temporal patterns in the harvest.
- Prepare a minimum of one peer-reviewed manuscript from the updated PSAMP sea duck dataset.

Figure 1. Washington MWS - Snow Geese (Skagit-Fraser winter flock)

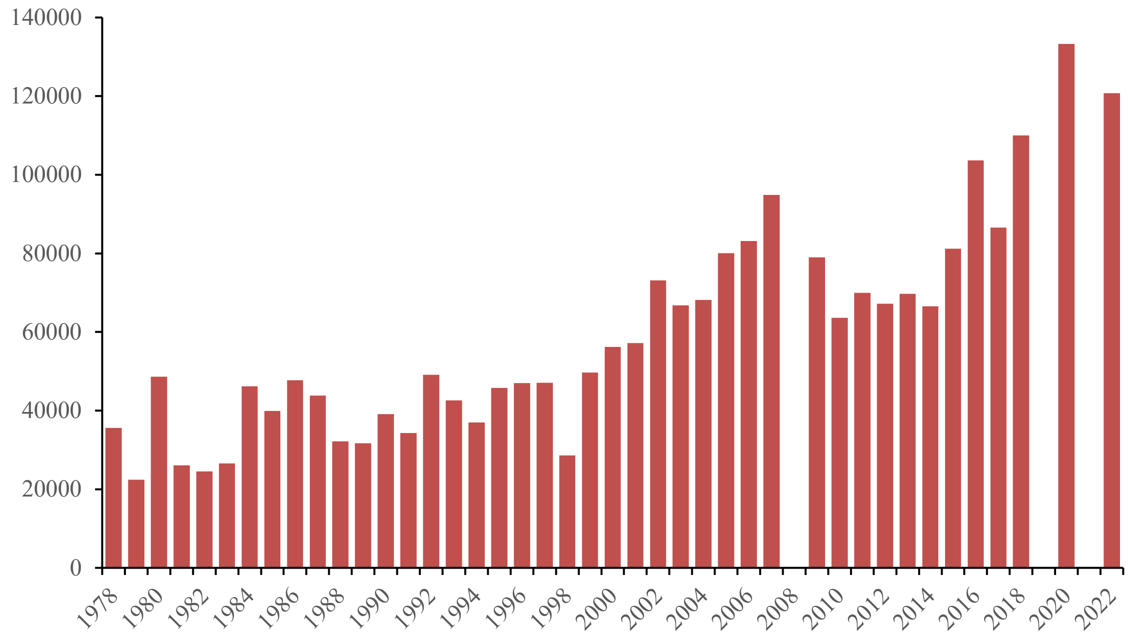


Figure 2. Washington MWS - Brant

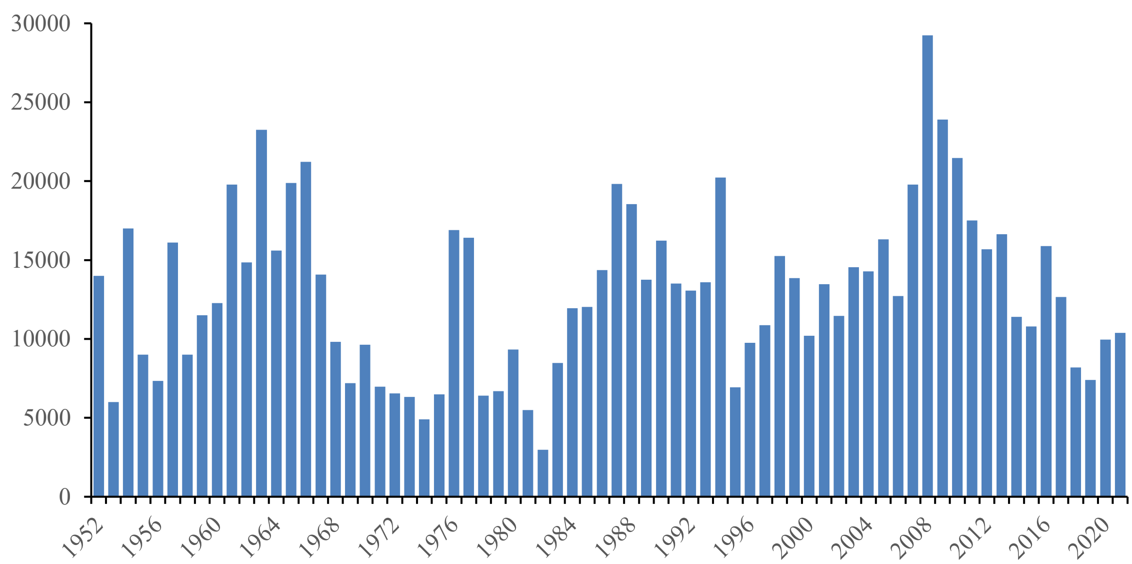


Figure 3. Washington Goose Management Areas.

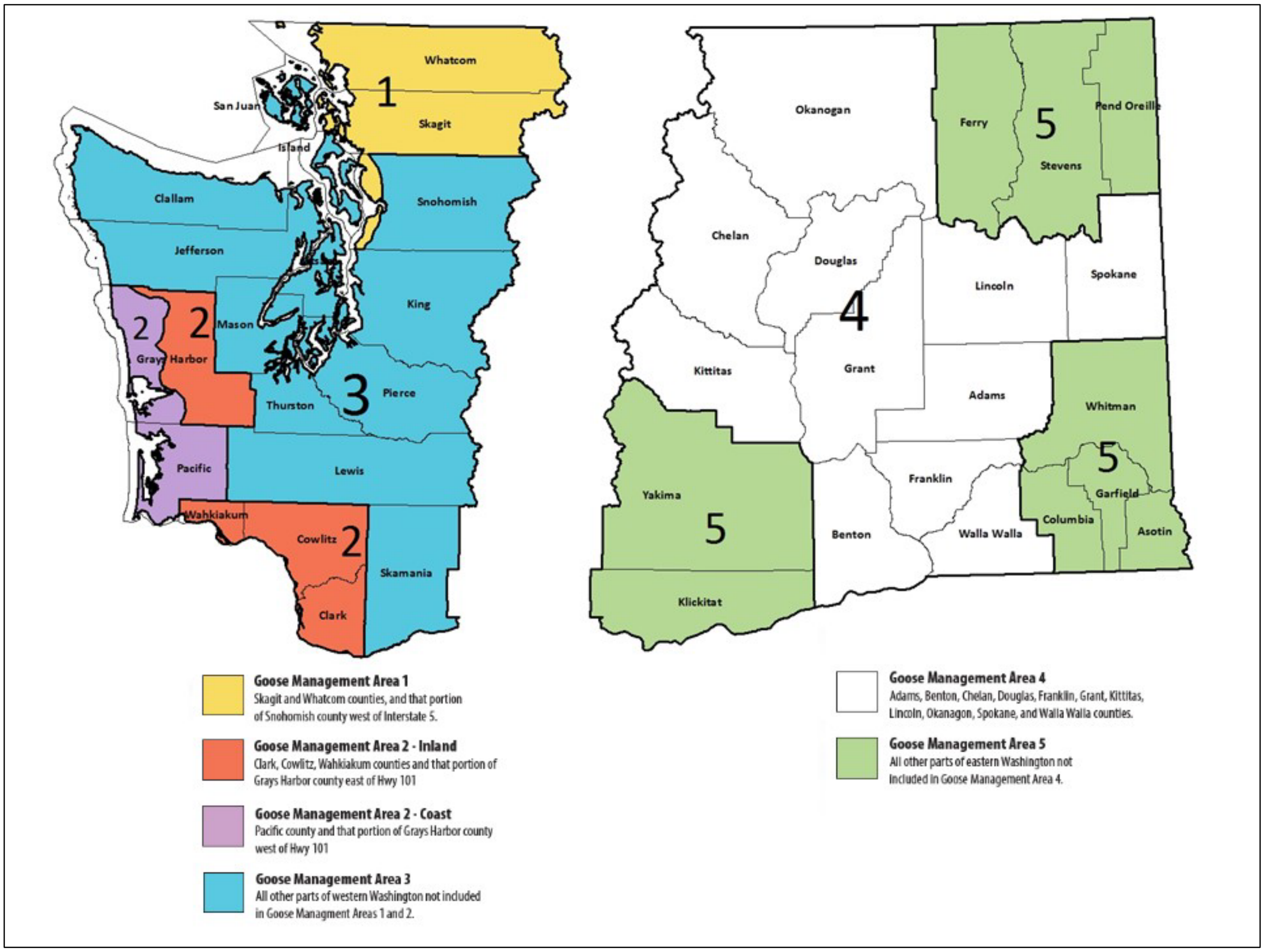


Figure 4. Washington total duck harvest time-series (1962-2022). Long-term Average (LTA) indicated by dashed blue line. Long-term Average under Adaptive Harvest Management National Strategy (AHM 1997-2022) indicated by dashed gold line.

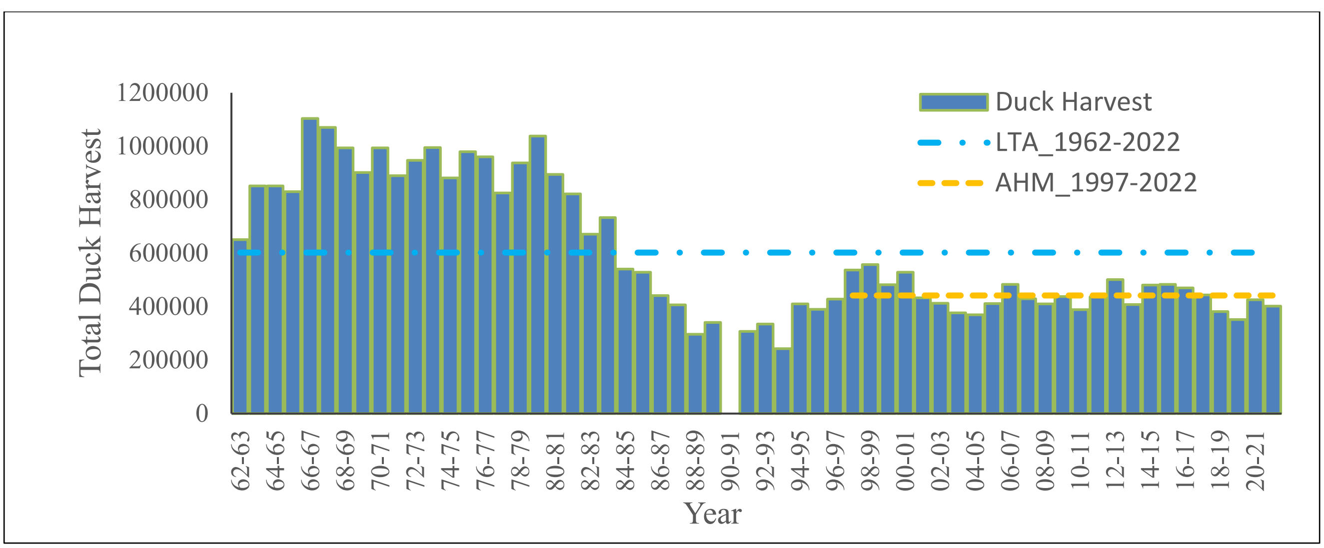
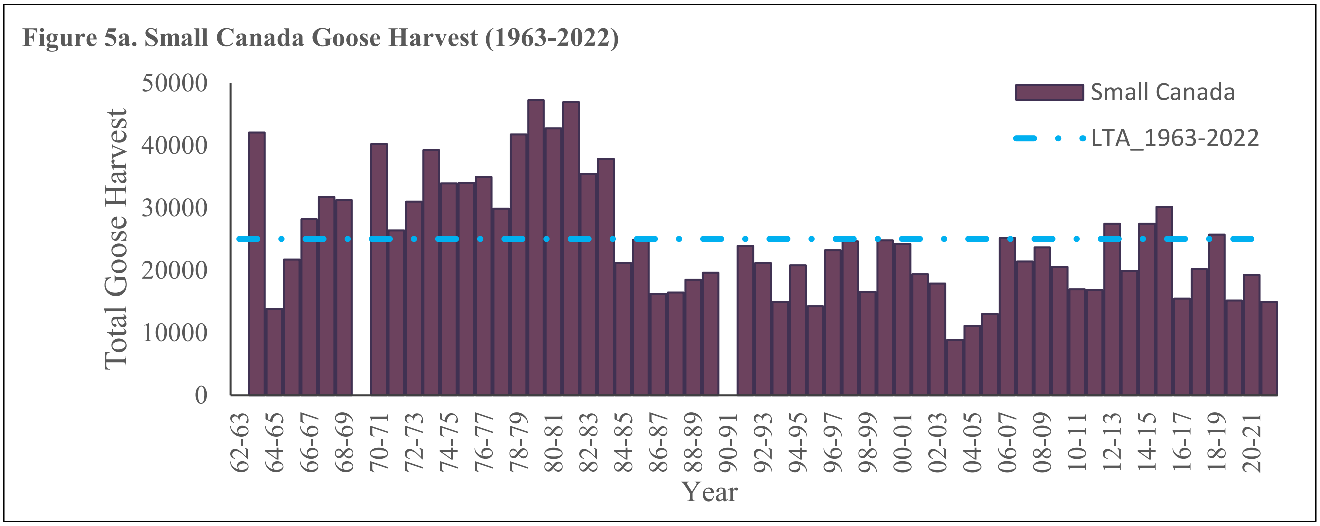


Figure 5. Small (a) and large (b) Canada goose harvest time-series in Washington (1963-2022). Long-term Average (LTA) indicated by dashed blue line.



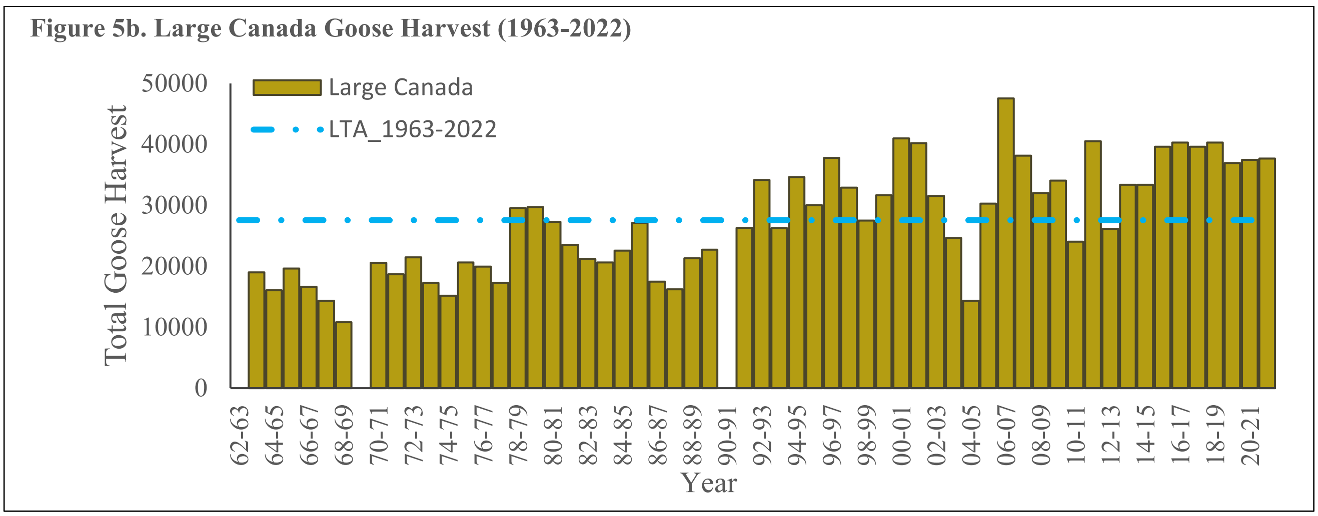


Figure 6. Washington active duck hunter time-series (1962-2022). Long-term Average (LTA) indicated by dashed blue line. Long-term Average under Adaptive Harvest Management National Strategy (AHM 1997-2022) indicated by dashed gold line.

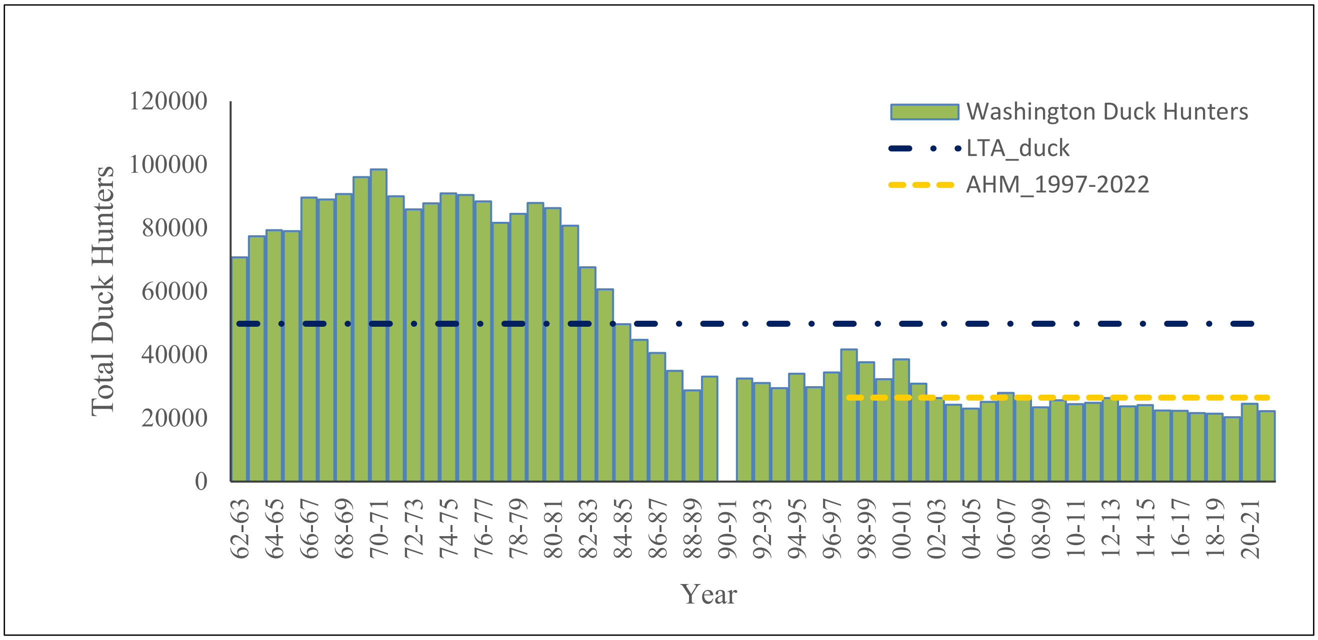


Figure 7. Washington duck hunter success time-series (1962-2022). Long-term Average (LTA) indicated by dashed blue line. Long-term Average under Adaptive Harvest Management National Strategy (AHM 1997-2022) indicated by dashed green line.

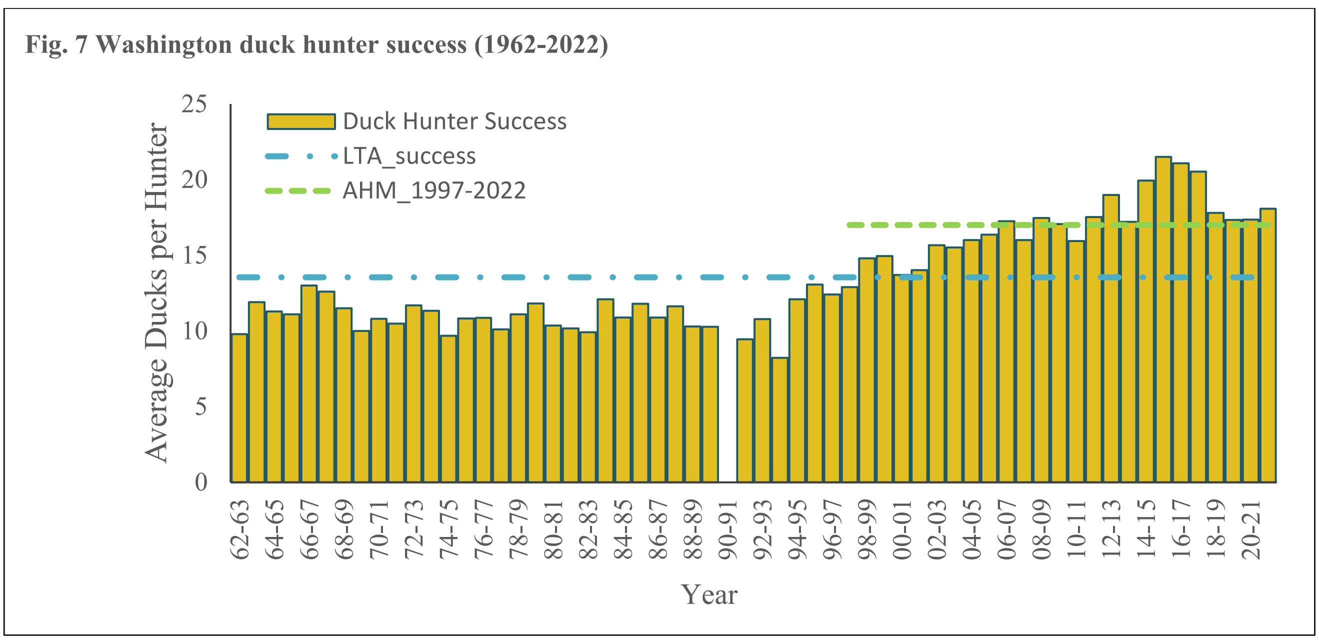


Figure 8. Reported harvest recoveries of mallard banded in Washington from deployments occurring between 1947 – summer 2020. Yellow markers indicate reported harvest recoveries during the 2021-2022 duck hunting season.

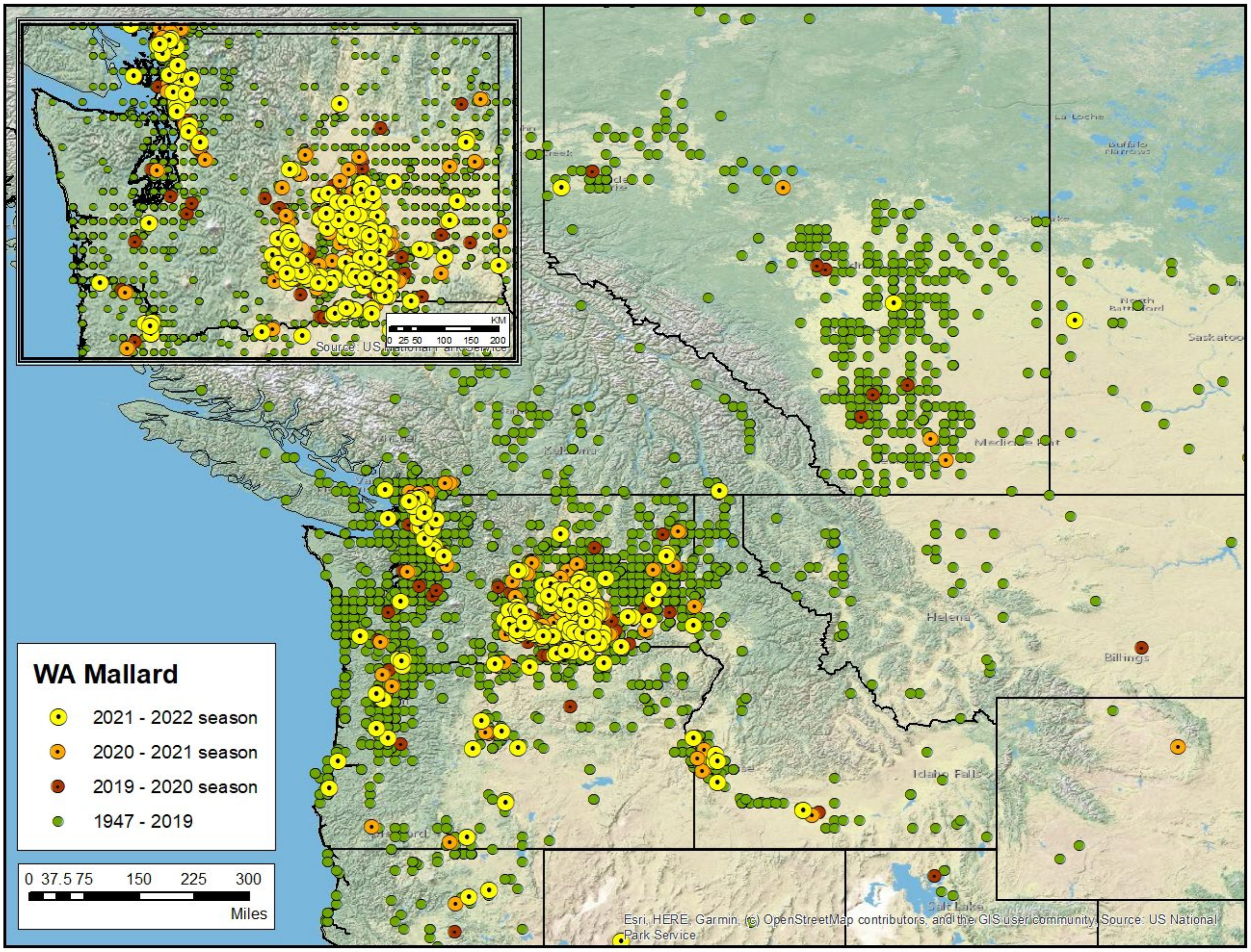


Figure 9. Reported harvest recoveries of Western Canada geese banded in Washington from deployments occuring between 1950 – summer 2020. Yellow markers indicated reported harvest recoveries during the 2021-2022 goose seasons, including special September season dates.

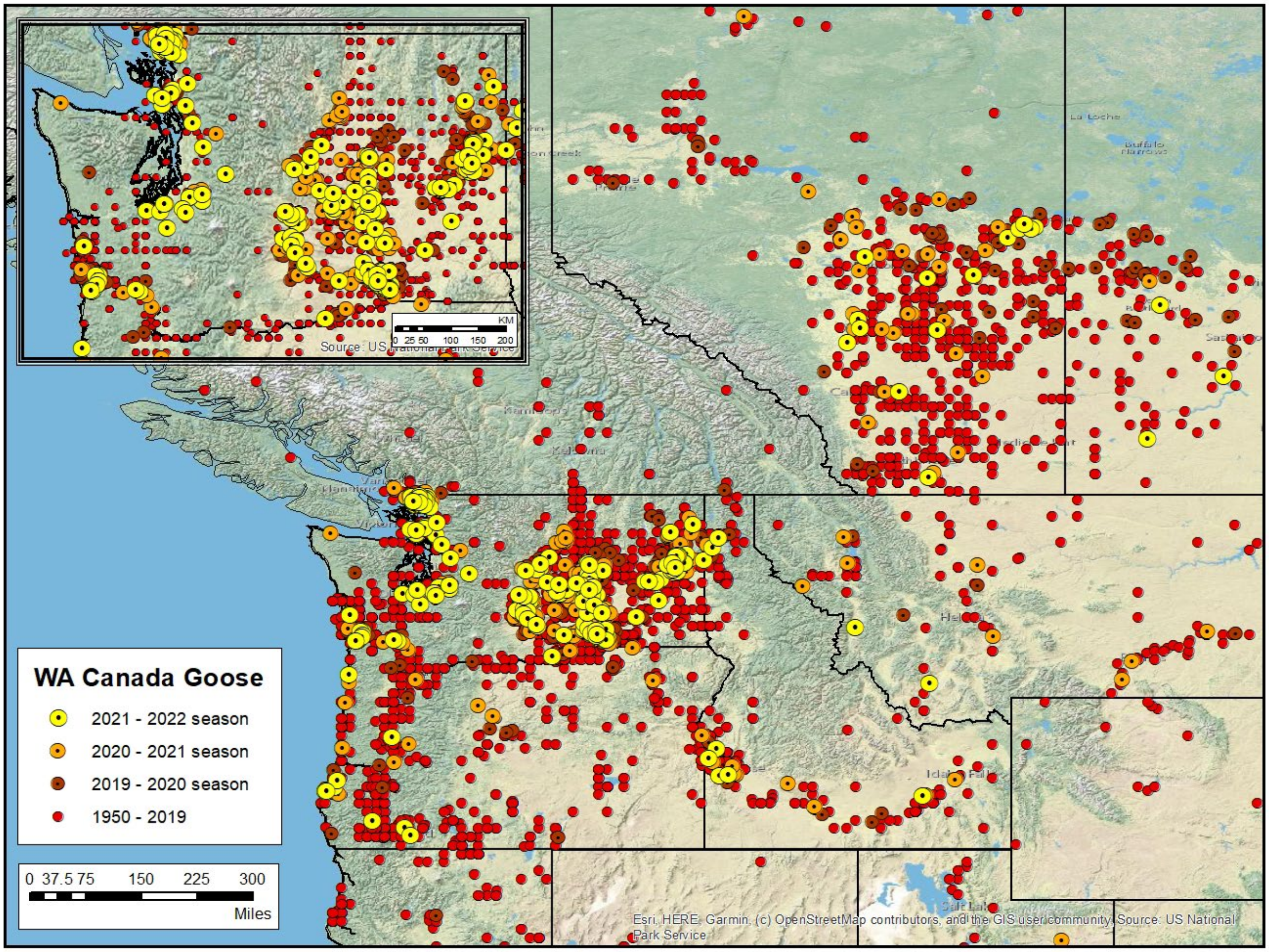


Table 1. Washington Department of Fish and Wildlife Midwinter Waterfowl Survey (MWS) – January 2007 - 2018.

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%	297,666
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%	3,594
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%	121,208
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%	17,330
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%	3,015
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%	78,679
Wood Duck	99	378	309	1,406	501	380	150	9,796	220	149	340	55	-84%	-96%	1,331
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%	2,299
Canvasback	1,501	3,790	3,239	3,789	3,148	2,157	1,528	462	1,489	3,437	719	641	-11%	-69%	2,061
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%	44,452
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%	9,241
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%	11,403
	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%	20,461
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%	2,169
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%	10,571
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%	7,586
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%	5,535
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%	60,505
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%	39,498
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%	16,808
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%	2,414
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%	12,473
Unknown Swan**	842	292	1,100	540	221	1,775	2,381	3,609	2,929	1,823	826	1,123	36%	-31%	1,633
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%	767,260
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			72,954
B.C. Snow Geese	8,007	12,276	2,495	7,788	24,285	22,265	10,225	19,633	17,309	11,954					14,494

**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	2022 Estimate	% change from 2020	Long Term Average	% change from LTA	3-year Winter Index	% above Harvest Closure Threshold	Current Regulation Package
All Scoters	53109	4.0	60909.6	-12.8	50828.0	13.0	Restrictive - 2
Surf Scoter	36422	2.7	43885.5	-17.0			
White-winged Scoter	15085	6.7	15710.7	-4.0			
Black Scoter	1602	10.7	1313.4	22.0			
Common Goldeneye	15490	8.2	17661.3	-12.3			
Barrow's Goldeneye	11258	16.6	12587.3	-10.6			
Bufflehead	61053	1.0	66039.0	-7.6			
Harlequin Duck	3913	-17.1	4538.6	-13.8			
Long-tailed Duck	5192	18.6	5253.4	-1.2			
Red-breasted Merganser	18518	-22.7	12976.6	42.7			
Common Merganser	5986	54.1	4758.1	25.8			
Hooded Merganser	2047	-30.1	1723.4	18.8			
Total Sea Ducks	*176566*	*0.7*	*186447.3*	*-5.3*			
All Washington Salish Sea Basins							

Table 3. 2021-2022 survey results for snow goose photo and fly-off counts, brant surveys, swan age-ratio counts.

Snow Goose Counts	**Date**	**Estimate (min. count)**	**Survey Type**	**% Young**
Skagit-Fraser flock	3/4/2022	120,725 (3,019 SE)	Aerial – Photo Count	16
Columbia Basin flock	12/16/2021	119,771	Ground – Fly-off	N/A
Brant Winter Surveys	**Date**	**Count**	**Survey Type**	
Skagit	1/5/2022	2,750	Aerial – Visual	
Whatcom	1/2022	2,343	Aerial - Visual	
Clallam	1/14/2022	1,353	Boat-based – Visual	
Willapa	1/5/2022	3,944	Ground – Visual	
WA-portion of Pacific Flyway brant index	2022	**10,390**	mixed	
Swan Age Ratios				
Species	**Sample size**	**Juveniles**	**% Young**	
Trumpeter Swan – North Puget Trumpeter Swan - Clallam	14,425 164	1,961 31	13.6% 18.9%	
Tundra Swan	523	40	7.6%	

Table 4. 2021-2022 Washington migratory bird season regulations.

SPECIES	AREA	SEASON DATES	DAILY BAG LIMIT,
Duck	Western Washington Youth	Sept. 25[a]	7[b], 7[b]
	Eastern Washington Youth	Oct. 2[a]	7[b], 7[b]
	Youth, Veterans & Active Military (Statewide)	Feb. 5	7[b], 7[b]
	Statewide	Oct. 16-24 & Oct. 27 – Jan. 30, except Scaup season closed Oct. 16 – Nov. 5	7[b], 21[b]
Coot	Western Washington Youth	Sept. 25 and Feb. 5[a]	25, 25`
	Eastern Washington Youth	Oct. 2 and Feb. 5[a]	25, 25
	Statewide	Oct. 16-24 & Oct. 27 – Jan. 30	25, 25
Canada Goose September Seasons	Goose Management Areas 1 & 3	Sept. 4 - 9	5[c], 15[c]
	Goose Management Area 2 Coast and Inland	Sept. 4-12	5[c,d], 15[c,d]
	Goose Management Areas 4 & 5	Sept. 4-5	5[c], 10[c]

SPECIES	AREA	SEASON DATES	Canada Geese	White-Fronted Geese	White Geese
Goose (except Brant)	Note: Canada Geese are all types of Canada geese including cackling, Taverner's and Aleutian geese. White geese are snow and Ross' geese. Dusky Canada goose season is closed.		Canada Geese	White-Fronted Geese	White Geese
	Western Washington Youth (Goose Mgmt. Areas 1,2, & 3)	Sept. 25 (Canada and White-fronted Goose only)	4, 4	10, 10	N/A
	Eastern Washington Youth (Goose Mgmt. Areas 4 & 5)	Oct. 2 (Canada and White-fronted Goose only)	4 ,4	10, 10	N/A
	Youth, Veterans & Active Military (Statewide)	Feb. 5	4, 4	10, 10	10, 30
	Goose Mgmt. Area 1[e]	Regular Season: Oct. 16 – Nov. 28 and Dec. 11 – Jan. 30	4, 12	10, 30	10, 30
		Late Season (white goose only): Feb. 12 - 22.	N/A	N/A	20, 60
	Goose Mgmt. Area 2 – Coast[f] (includes Pacific County and Grays Harbor County west of Hwy 101)	All areas except Willapa National Wildlife Refuge: Everyday Oct. 16-31 Saturdays, Sundays, & Wednesdays only Nov. 3 – Dec. 5, Dec. 22 – Jan. 23, and Feb. 12 – 23. During Feb. 12 – 23, National Wildlife Refuges and WDFW Wildlife Areas are closed to goose hunting in this	4[g], 12[g]	10, 30	10, 30
		Willapa National Wildlife Refuge: Wednesday, Saturday, & Sunday only Oct. 16-31, Nov. 3 – Dec. 5, Dec. 22 – Jan. 23.			
	Goose Mgmt. Area 2 – Inland[f] (includes Clark, Cowlitz, Wahkiakum and Grays Harbor County east of Hwy 101)	All areas except Ridgefield National Wildlife Refuge: Everyday Oct. 16-31 Saturdays, Sundays, & Wednesdays only Nov. 24 – Jan. 16, and Feb. 12 – Mar. 9. During Feb. 12 – Mar. 9, National Wildlife Refuges and WDFW Wildlife Areas are closed to goose hunting in this management	4[g], 12[g]	10, 30	10, 30

		Ridgefield National Wildlife Refuge: Tuesdays, Thursdays, & Saturdays only Oct. 16-31 and Nov. 24 – Jan. 15.			
	Goose Mgmt. Area 3	Oct. 16-28 & Nov. 6 – Jan. 30	4, 12	10, 30	10, 30
	Goose Mgmt. Area 4 (delayed white goose opener)	Canada and White-Fronted Goose Only: Saturdays, Sundays, & Wednesdays only during: Oct. 16 – Nov. 3.	4, 12	10, 30	N/A
		All goose types: Saturdays, Sundays, & Wednesdays only during: Nov. 6 – Jan. 30; Everyday Jan. 24-30. Additional hunt days include: Nov. 11, 25, 26 Dec. 24, 27, 28, 30, & 31; and Jan. 17.	4, 12	10, 30	10, 30
		White Goose Only: Feb. 12 – Mar. 2	N/A	N/A	20, 60
	Goose Mgmt. Areas 5	Oct. 16 – Nov. 1 & Nov. 6 – Jan. 30	4, 12	10, 30	10, 30
			DAILY BAG LIMIT, POSSESSION LIMIT		
Brant	Skagit County	Jan. 15 and 22, additional season dates determined by aerial survey results. Season updates provided by WDFW news release (**no additional days approved in 2021 season**)	2, 6		
	Clallam & Whatcom	Jan. 15, 19 and 22	2, 6		
	Pacific County	Jan. 8, 9, 11, 13 15, 16, 18, 20, 22, 23, 25, 27, 29 and 30	2, 6		
	Youth, Veterans & Active Military (Skagit, Clallam, Whatcom & Pacific)	Feb. 5	2, 2		

a. Special youth hunting days 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, 2 scaup, 2 canvasback, and 2 redhead statewide; and to include not more than 1 harlequin (see season limit). 2 scoter, 2 long-tailed ducks, & 2 goldeneye in western Washington. Possession limit (youth hunting days): Same as daily bag limit. Possession limit (Regular Season): 21 ducks, to include not more than 6 hen mallard, 3 pintail, 6 scaup, 6 canvasback, and 6 redhead statewide; and to include not more than 1 harlequin (season limit), 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. Daily bag and possession limits in Pacific County are 15/45 during the September Canada goose season.
e. Skagit County and Whatcom 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 Whatcom 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.
f. In Goose Management Area 2, legal hunting hours for geese are 30 minutes after the start of the official waterfowl hunting hours to 30 minutes before the end of the official waterfowl hunting hours.
g. 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,a]	105[6,a]	7	7	" "	2	17.00	15.00	40.50	
15-16	105[6,a]	105[6,a]	7	7	" "	2	17.00	25.00	40.50	Copper-clad iron added
16-18	105[6,a]	105[6,a]	7	7	" "	1	17.00	25.00	40.50	
18-19	105[6,a]	105[6,a]	7	7	" "	2	17.00	25.00	40.50	
19-22	105[6,a]	105[6,a]	7	7	7 (2 ♀)	1	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 (first Sat. in Nov.; day 23, no split, an additional 2 special hunt days)

Table 6. History of southwest Washington Canada goose season regulations.

Year	Season	ID Class	Quota	Scheduled Dates (# days)	Closure (# Days Hunted / Sched.)
2002-03	Regular	New	80	2A: Nov. 27-Jan. 26 (25-27) 2B: Nov. 9-Dec. 29 (23)	2A: RF (9/25)*, Others (27/27) 2B: No (23/23)
	Late	New	5	Feb. 1-Mar. 9 (17) – 2A* only	No (17/17)
2003-04	Regular	New	80	2A: Dec. 9-Jan. 24 (19) 2B: Nov. 15-Jan. 4 (15)	2A: RF (9/19)*, Others (19/19) 2B: No (15/15)
	Late	New	5	Jan. 31- Mar. 10 (12) – 2A* only	No (12/12)
2004-05	Regular	New	80	2A: Nov. 27-Jan. 22 (15, RF 25) 2B: Oct. 16-Jan. 15 (14)	2A: No (15/15, RF 25/25) 2B: No (14/14)
	Late	New	5	Feb. 5 - Mar. 9 (10) – 2A* only	No (10/10)
2005-06	Regular	New	80	*2A: Nov. 12-27, Dec. 7-Jan. 29 (30, RF 25)* 2B: Oct. 15-Jan. 14 (27)	2A: No (30/30, RF 25/25) 2B: No (27/27)
	Late	New	5	Feb. 5 - Mar. 9 (10) – 2A* only	No (10/10)
2006-07	Regular	New	80	*2A: Nov. 11-26, Dec. 6-Jan. 28 (32, RF 25)* P: Oct. 15-Jan. 14 (27)	2A: No (32/32, RF 25/25) P: No (27/27)
	Late	New	5	Feb. 3 - Mar. 7 (10) – 2A* only	No (10/10)
2007-08	Regular	New	80	*2A: Nov. 10-25, Dec. 5-Jan. 27 (32, RF 25)* P: Oct. 13-Jan. 12 (27)	2A: No (32/32, RF 25/25) P: No (27/27)
	Late	New	5	Feb. 2 - Mar. 5 (10) – 2A* only	No (10/10)
2008-09	Regular	New	80	2A: Nov. 8-23, Dec. 3-Jan. 25 (32, RF 26) P: Oct. 11–Jan. 10 (27)	2A: No (32/32, RF 26/26) P: No (27/27)
	Late	New	5	Feb. 7 – Mar. 7 (9)	No (9/9)
2009-10	Regular	New	40	2A: Nov. 14-20, Dec. 9-Jan. 31 (31, RF 28) P: Oct. 17–Jan. 16 (27)	2A: No (31/31, RF 28/28) P: No (27/27)
	Late	New	5	Feb. 6 – Mar. 10 (10)	No (10/10)
2010-11	Regular	New	40	2A: Nov. 13-28, Dec. 8-Jan.30 (30, RF 27) P: Oct. 16–Jan 15 (26)	2A: Yes (30/30, RF 5/27) P: No (26/26)
	Late	New	5	2A: Feb. 5 – Mar. 9 (10)	No (10/10)
2011-12	Regular	New	40	2A: Nov. 12-27, Dec. 7-Jan.29 (30, RF 29) P: Oct. 15–26 and Nov. 5-Jan 21 (26)	2A: Yes (30/30, RF 16/29) P: No (26/26)
	Late	New	5	2A: Feb. 4 – Mar. 7 (10)	No (10/10)
2012-13	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)
2013-14	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)
2014-15	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 / Sched.)
2015-16	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)
2016-17	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)
2017-18	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)
2018-19	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)
2019-20	Regular – Coast	New	N/A**	2C: Oct. 12 – 27; Nov. 2 – Dec. 1, Dec. 21 – Jan. 19 (44, WB 35)	2: No (38/38, WB 35/35)
	Late – Coast	New	N/A**	2C: Feb. 8 – Feb. 22*** (7)	2: No (7/7)
	Regular – Inland	New	N/A**	2I: Oct. 12 – 27; Nov. 23 – Jan. 12, (38, RF 30)	2: No (38/38, RF 30/30)
	Late – Inland	New	N/A**	2I: Feb. 8 – Mar. 7*** (13)	2: No (13/13)
2020-21	Regular – Coast	New	N/A**	2C: Oct. 17 – Nov 1; Nov. 4 – Dec. 6, Dec. 23 – Jan. 24 (44, WB 35)	2: No (41/41, WB 38/38)
	Late – Coast	New	N/A**	2C: Feb. 13 – Feb. 24*** (6)	2: No (6/6)
	Regular –Inland	New	N/A**	2I: Oct. 17 – Nov 1; Nov. 25 – Jan. 17, (38, RF 30)	2: No (39/39, RF 31/31)
	Late – Inland	New	N/A**	2I: Feb. 13 – Mar. 10*** (12)	2: No (12/12)

* 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 during 2021-2022)[1].

Species	Harvested	Composition (%)
Mallard	181,786	45.2
Northern pintail	21,688	5.4
American wigeon	85,580	21.3
Green-winged teal	40,079	9.9
Total ducks	402,158	
Large Canada (Sept Season[2])	37,703 (8,038)	48.4
Small Canada	14,936	19.2
White goose (Snow + Ross')	24,812	36.6
Total geese	77,847	
Total waterfowl	**483,019**	

[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 assumed to be only Large Canada geese and is considered in the composition of Large Canada goose to the total goose harvest statewide, but is excluded from deriving small Canada goose.

Table 8. Waterfowl harvest by region during 2021-2022.

Region	Ducks Harvested	% of State Total Ducks Harvested	Geese Harvested[1]	% of State Total Geese Harvested
Region 1	51,696	13%	14,282	18%
Region 2	83,541	21%	24,652	32%
Region 3	83,301	21%	13,481	17%
Region 4	117,870	29%	17,727	23%
Region 5	28,373	7%	3,435	4%
Region 6	37,377	9%	4,306	6%

[1] Goose harvest estimates include: September Canada Goose harvest, regular season goose harvest, and mandatory harvest report card estimates from Region 5 and Region 6 (Southwest Washington Canada goose harvest estimate).

Table 9. Estimated number of sea ducks harvested in 2021-2022.

Species[1]	Harvest Estimate[2]
Scoters	1,046
Black Scoter	63
Surf Scoter	746
White-winged Scoter	237
Harlequin Duck	297
Long-tailed Duck	160
Barrow's Goldeneye	311
Common Goldeneye	210
TOTAL	**2,024**

[1] Species composition is derived from mandatory harvest reports.

[2] These estimates are derived from mandatory reports, corrected for non-response bias.

Table 10. Brant harvest report summary[1].

YEAR	MONTH	PERMITS ISSUED	SUCCESSFUL HUNTERS	HUNTER DAYS		SKAGIT CO. HARVEST	WHATCOM CO. HARVEST	CLALLAM CO. HARVEST	PACIFIC CO. 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
2019	JAN		243[a]	519	2S/3W/ 3C/14P/ 1YVM[b]	104	28	46	72	246
2020	JAN	3471	344	563	3S/3W/ 3C/14P/ 1YVM[b]	295	78	156	106	666
2021	JAN	3964	515	825	2S/3W/ 3C/14P/ 1YVM[b]	561	124	180	126	1042

[1]Figures based on mandatory report returns, corrected for non-response bias, days hunted estimate from 1990-08 include successful hunters only.

[a] 2019 estimate likely reflects number of individual hunters that went out a min. of 1-day, not successful-only.

[b]YVM = Youth, Veterans, and Active Military special hunt date first Sat. of February, which included brant as allowable species.

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	
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[a]
2019	NA	1628[b]	9819	32	3916	2450	6398[a]
2020	6302	1644	5148	NA	3003	2035	5176
2021	7076	1895	5123	478[c]	4339	1697	6590

*days hunted 1993-08 include successful hunters only **harvest estimate does not include wounding loss

[a] Corrected for non-compliant reports

[b] 2019 estimate likely reflects number of individual hunters that went out a min. of 1-day, not successful-only

[c]2021 estimate is for Whatcom County, which replaced Island County in the modified GMA-1 boundary.

Table 12. Southwest Washington Canada goose harvest summary.

Season	Period	Aleutian	Cackler	Dusky	Lesser	Taverner	Vancouver	Western	Other	Total CAGO	Snow	Whitefront	Total
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			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

Table 12. Southwest Washington Canada goose harvest summary. (Continued)

Season	Period	Aleutian	Cackler	Dusky	Lesser	Taverner	Vancouver	Western	Other	Total CAGO	Snow	Whitefront	Total
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		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

Table 12. Southwest Washington Canada goose harvest summary. (Continued)

Season	Period	Aleutian	Cackler	Dusky	Lesser	Taverner	Vancouver	Western	Other	Total CAGO	Snow	Whitefront	Total
2018-19 [a]	Season total[c,d]	6	407	16	37	86	0	60	5	617	17	17	651
2019-20 [a]	Season total[c,d]	3	335	12	10	59	4	56	5	482	0	21	503
2020-21 [a]	Season total[c,d]	0	238	6	3	13	0	23	0	283	1	2	286
2021-22 [a]	**Season total[c,d]**	**0**	**202**	**1**	**3**	**20**	**0**	**15**	**0**	**241**	**2**	**1**	**244**

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 Specialist

Management Guidelines and Objectives

Wild turkeys were first successfully introduced in Washington in 1960. Population augmentation from 1984 through 2003 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) to supplement the Game Management Plan in response to increasing population and turkey management topics. Population management strategies from this plan were included and updated in the 2015-2021 Game Management Plan (WDFW, 2014). The statewide management goals for wild turkeys are to:

1. Preserve, protect, perpetuate, and manage wild turkeys and their habitats to ensure healthy, productive populations.
2. Manage wild turkeys for various recreational, educational, and aesthetic purposes, including hunting, scientific study, wildlife viewing, cultural and ceremonial uses by Native Americans, and photography.
3. Manage statewide wild turkey populations for a sustained harvest.

Hunting Seasons and Recreational Harvest

Hunter effort and 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 have been tracked at the PMU level as an indicator of population trends. Improvements were made to the turkey harvest data analysis routine in 2011 and 2016, which could account for some variations in estimates and should be considered 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 statewide spring general season from April 15 to May 31 has been in place since 2008. The general season is preceded by a 2-day youth season. The spring season is for male turkeys and turkeys with visible beards only. The spring season limit is three birds, with some area restrictions. In 2020, the spring season was delayed and the youth season was cancelled due to health and safety concerns during the early outbreak of the COVID-19 pandemic. Instead of the usual April 15th opening, the spring season opened on May 5th, 2020. During the shortened season, hunters were encouraged to hunt locally to reduce the risk of spreading the disease to rural communities. In 2021, the spring season resumed the April 15 start date.

Fall opportunities have varied and generally expanded over the years. In 2018, the fall general season in GMUs 101-154 and 162-186 expanded to run continuously from September 1 to December 31. Also, in that year, the permit hunt in Klickitat County changed to a fall general season opportunity. In 2021, the Klickitat hunt lengthened to match the September 1 to December 31 general season, along with the entire North Central unit (PMU20). This eliminated the Methow fall permit hunt since the area became open to general season hunting. The fall seasons allow harvest of either sex with a bag limit of four birds with some area restrictions as outlined in the WDFW hunting regulations pamphlets.

One permit hunt, the Teanaway, was available in fall 2021. This hunt offered 50 permits in Kittitas County, GMU 335, and allowed harvest of either sex with a bag limit of one bird.

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. The spring season timing results in the 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.

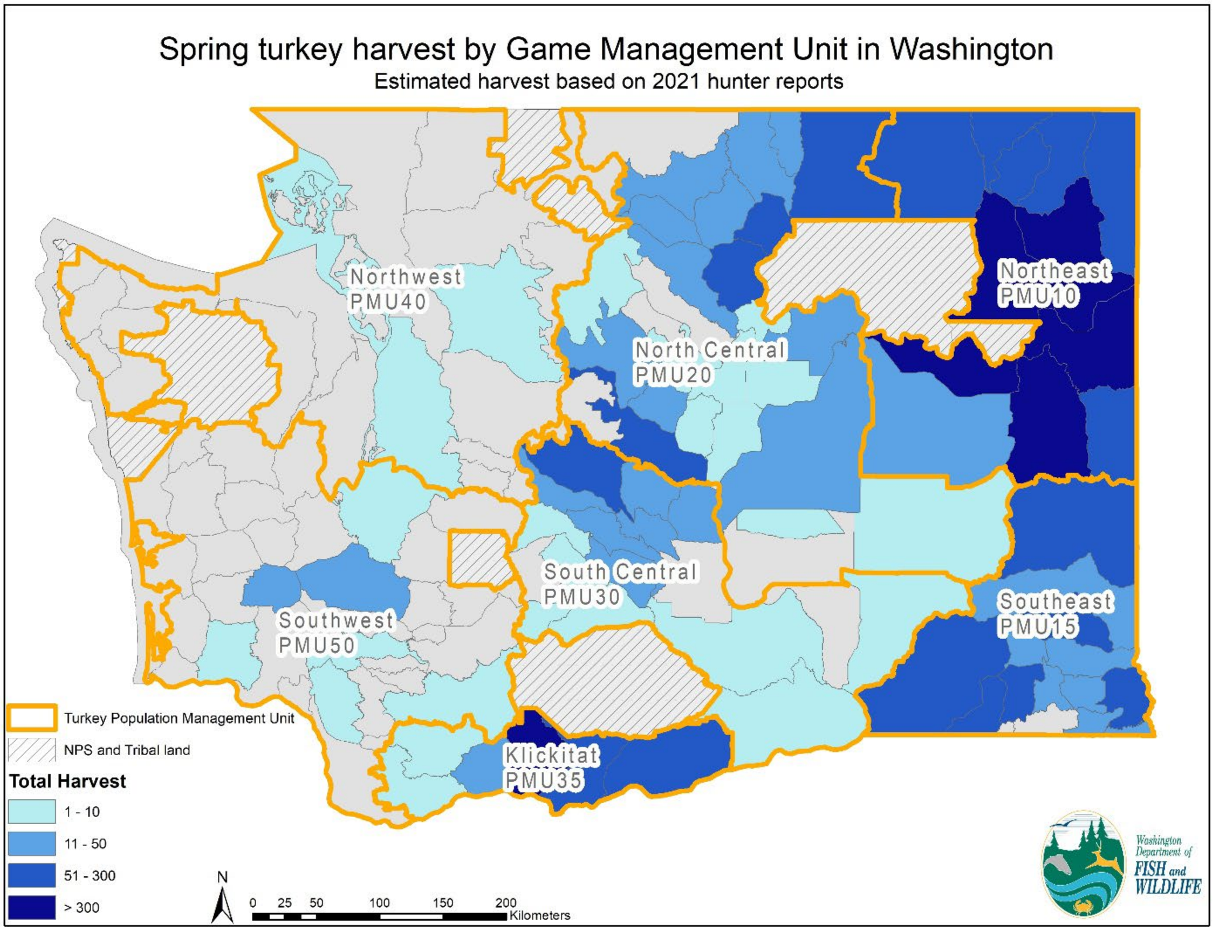


Figure 1. Estimated spring turkey harvest in each Game Management Unit based on 2021 hunter reports.

Statewide participation in spring turkey hunting averaged 11,445 hunters since 2012 (Figure 2). In 2021, participation increased 63% from 2020 to 15,557 hunters, which puts 2021 participation 42% above the previous average from 2012-2020. Estimated harvest had shown a fairly steady increase over the same period, excepting a drop in 2020, averaging 4,891 birds. In 2021, harvest increased 57% from the previous year, rising 61% above the 2012-2020 average of 4,611.

Depredation on agricultural land caused by turkeys and conflicts with humans remains a concern in parts of eastern Washington. Liberal fall general seasons are in place here and have recently expanded to help address these issues. This change in season length and extent should be considered when examining trends in fall harvest data. Participation in fall hunting continues to increase, with fall harvest following suit until a downturn in 2021 (Figure 3). Since 2012, an average of 3,856 hunters have pursued turkey each fall, taking an average of 2,010 birds each year. In 2021, hunter participation increased 9% from the previous year to 5,454 hunters, which is 48% above the previous 2012-2020 average. Fall harvest in 2021 (2,730 birds) decreased 14% from 2020 but remains 41% above the previous average of 2012-2020.

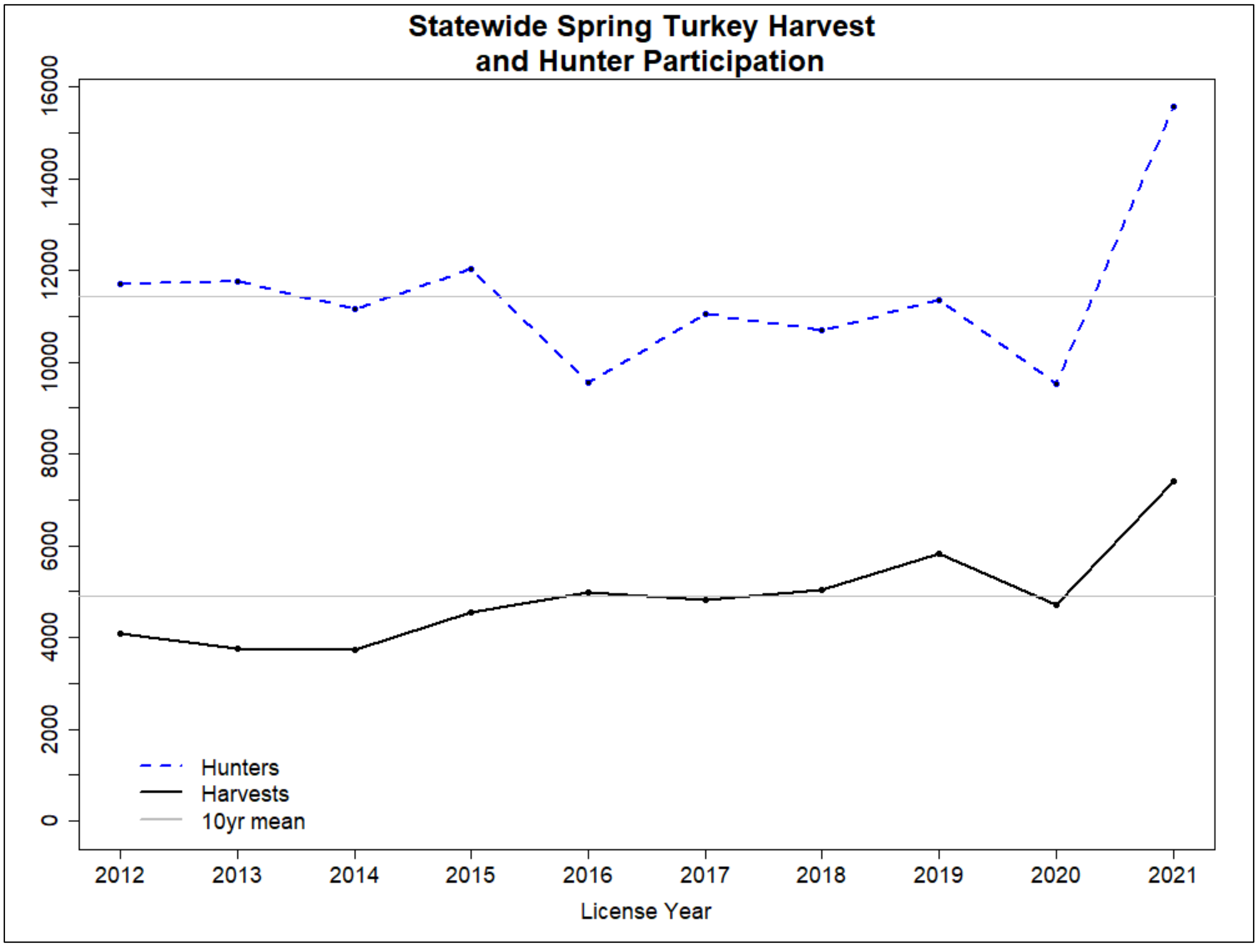


Figure 2. Estimated statewide spring turkey harvest and hunter participation, 2012-2021, with 10-year means.

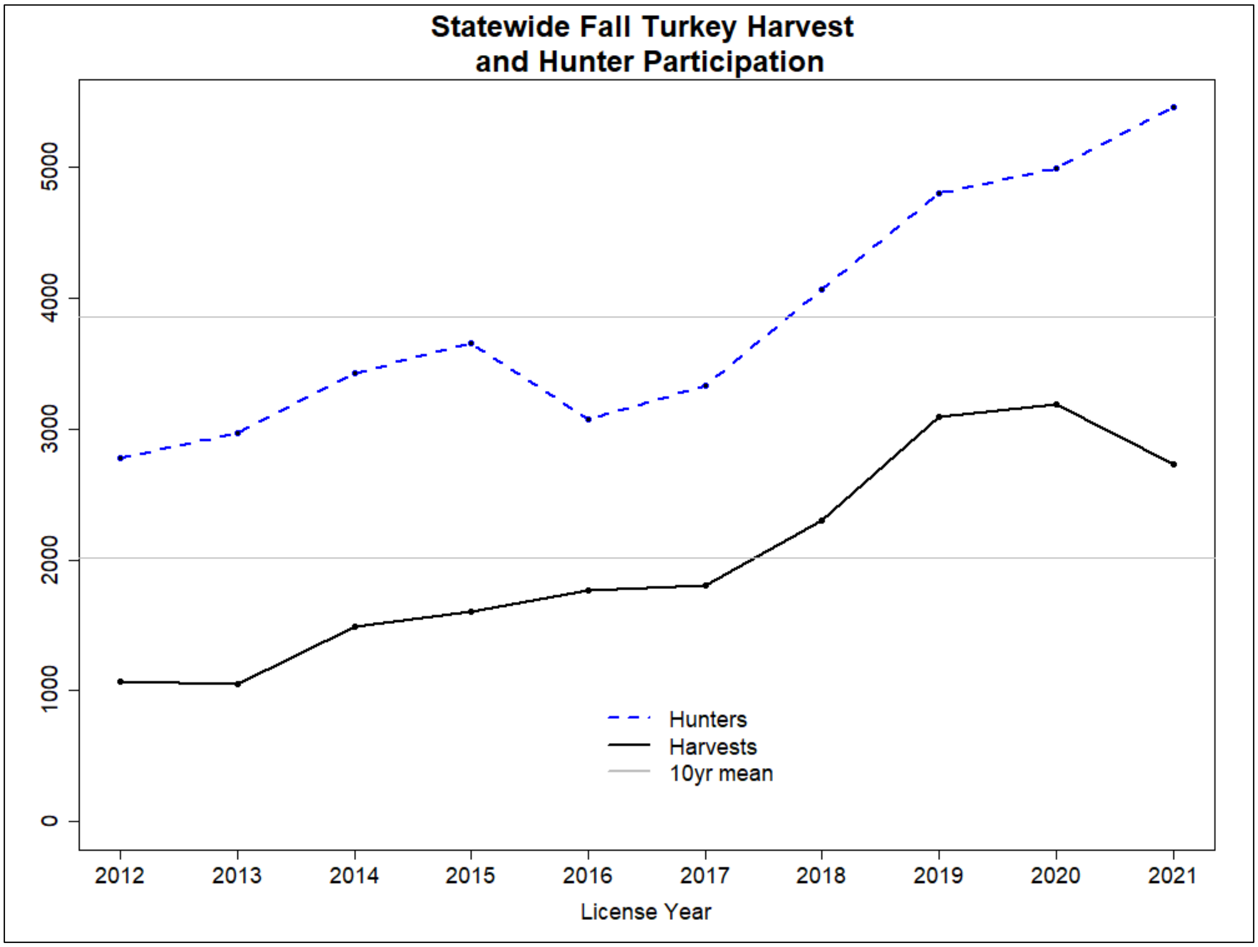


Figure 3. Estimated fall turkey harvest and hunter participation, 2012-2021, with 10-year means.

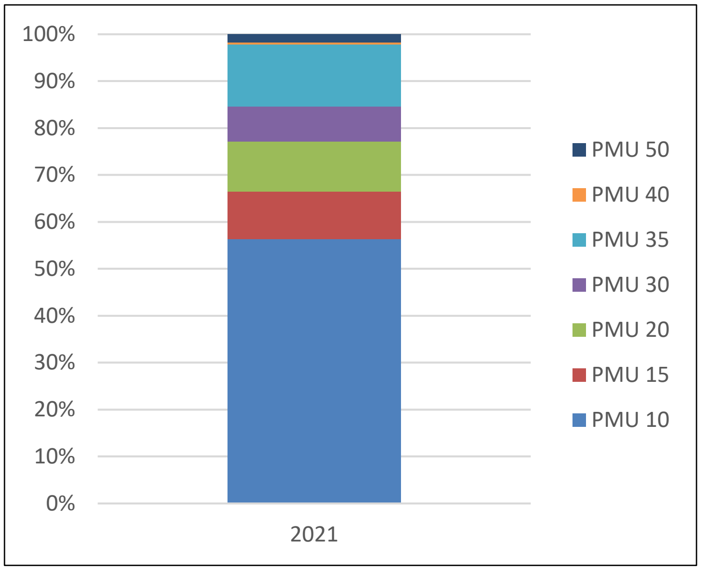


Figure 4. Proportion of days hunted in each Population Management Unit (PMU) out of the total number of days hunted statewide in the 2021 spring season.

The majority of spring turkey hunting activity occurs in the northeast (PMU 10; Table 2). In 2021, spring harvest in this PMU represented 56% of the total statewide spring harvest. The remaining hunting activity is largely distributed through eastern Washington, with little hunting in western Washington (PMU 40 and 50) where turkey populations are less robust.

Table 2. Estimated spring turkey harvest in each turkey Population Management Unit (PMU) 2012-2021.

PMU	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
P10	2,512	2,400	2,461	3,097	3,421	3,331	3453	3847	3177	5006
P15	642	533	500	531	590	499	563	643	461	673
P20	203	188	181	260	270	331	326	480	427	641
P30	162	143	137	157	208	175	172	186	156	305
P35	514	474	436	475	461	417	456	598	461	729
P40	5	5	1	3	2	5	23	12	0	14
P50	30	25	25	38	28	56	25	39	24	51

Population Monitoring

Harvest and hunter-effort data are used as an index to population trends. Standardizing harvest estimates by the amount of hunter effort expended to achieve that level of harvest can provide some indication of whether populations are increasing, decreasing, or stable.

Since 2012, hunter success has averaged 43% during the spring season (Figure 5). In 2021, spring hunter success remained well above this average, despite continuing a slight decrease since 2019 to 48%. The fall season averaged 51% over the same 10-year period. In 2021, fall success dropped to 50%, falling more in line with spring hunter success.

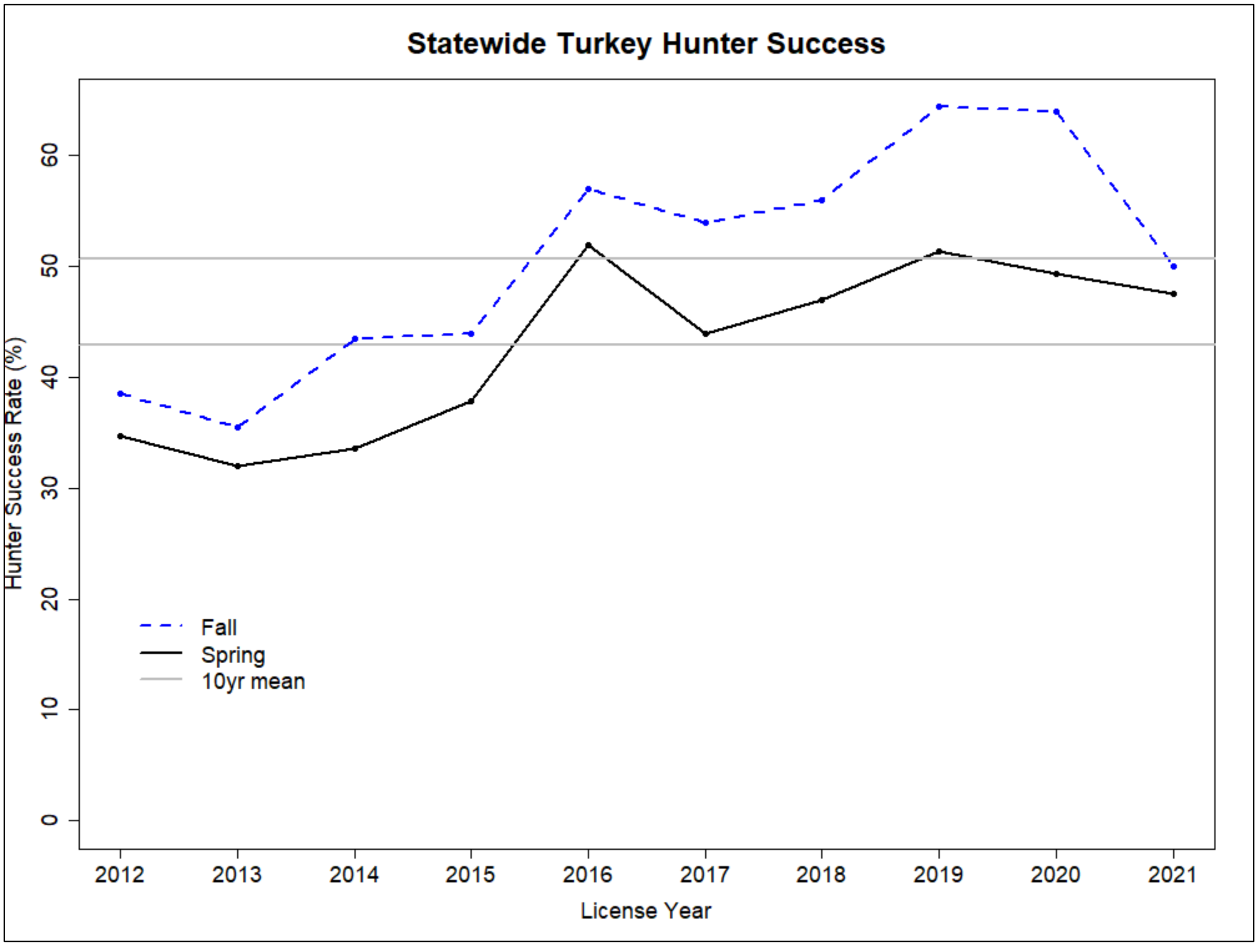


Figure 5. Hunter success rate (harvests per hunter) for the spring and fall seasons, 2012 – 2021 with 10-year means.

Within each PMU, the number of days hunted per harvest is variable, but all units show a stable to decreasing trend, indicating that populations at the PMU level are stable to increasing, with the exception of northwestern Washington (PMU 40; Figure 6). Very little hunting activity occurs in this unit, so small sample sizes make any assessment of trends difficult.

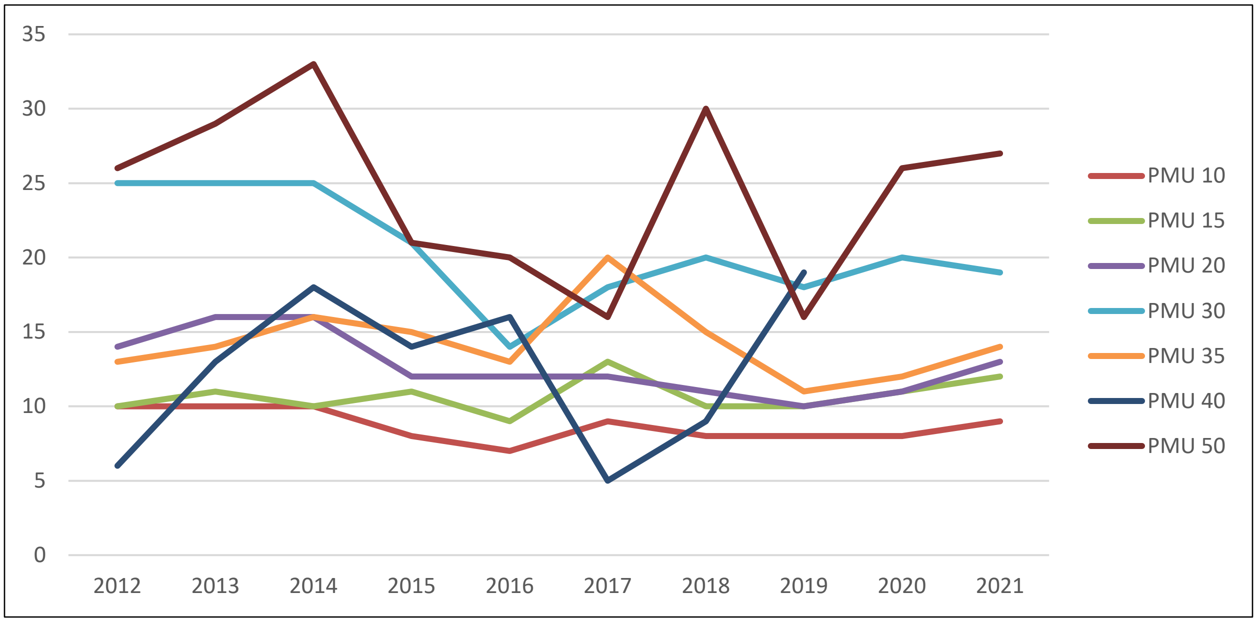


Figure 6. Number of days hunted per successful harvest during the spring season in each PMU, 2012-2021.

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 various wildlife species in addition to turkeys. In spring of 2022, WDFW invested funding from turkey tag sales into restoring native grass and shrub communities on lands recently acquired by the Department in the Asotin Creek Wildlife Area. These lands provide winter and nesting habitat for turkeys in addition to benefitting elk and other species but had been degraded by historical grazing and recent fire.

WDFW works closely with the National Wild Turkey Federation (NWTF) on efforts to promote, fund, and implement habitat enhancement work. In spring of 2022, WDFW collaborated with NWTF to support the Middle Wind Habitat Improvement Project on the Gifford Pinchot National Forest to restore native plant communities. Improving habitat for Merriam's turkey in this area is intended to help draw turkeys onto public land and decrease their use of private lands.

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 recent past. WDFW management plans identify trapping and translocation as a potential response to damage and complaints, but in these cases, turkeys are only being moved to areas where turkey populations of the same subspecies already exist. Few translocation activities have occurred in recent years.

Management Conclusions

Turkey populations across the state appear stable to increasing, with the largest concentrations in eastern Washington. After several years of increasing hunter success, the recent decline may indicate that populations are stabilizing. It will be important to continue close monitoring to ensure increased fall seasons are not adversely impacting populations. Turkey damage and complaints are being reported from eastern Washington, especially Spokane County. Additional hunting opportunities have been created in these areas to help address these complaints. WDFW will continue reviewing ways to focus hunter effort and other management tools in areas with private lands experiencing damage. Management decisions will seek to maintain high hunter success rates in the spring while also addressing human conflict issues. Please see the Wildlife Conflict report for more information.

Determining population trends for wild turkey in western Washington is limited by available data. Wild turkeys are likely reproducing at low levels but maintaining a viable population in PMU 50. Low harvest in this area may be further limited by restrictive access policies put in place by private landowners.

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Pheasant

Pheasant Status and Trend Report

STATEWIDE

SARAH GARRISON, Statewide Small Game 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 2021 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 ran 87 days from mid-October to mid-January in eastern Washington and 67 days from late September to the end of November in western Washington, with a 15-day early December 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. In western Washington, a pheasant release program exists to provide an upland bird recreational opportunity to western Washington hunters. During the 2021 season, 35,877 pheasants were released at designated sites in western Washington, and 4,543 licenses were purchased for this opportunity. For more information about the pheasant release program, see wdfw.wa.gov/hunting/locations/pheasant-release.

The number of pheasant hunters, harvests, and the number of days hunted are estimated based on a survey of multiple small game species mailed to a stratified random sample of 25,000 hunters. Estimates of harvest and hunter participation for this report include the following eastern Washington counties: Adams, Asotin, Benton, Chelan, Columbia, Douglas, Ferry, Franklin, Garfield, Grant, Kittitas, Klickitat, Lincoln, Okanogan, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman, and Yakima.

Participation in pheasant hunting peaked in the 1950s, while harvest peaked in the 1960s. Changing farming practices have deteriorated pheasant habitat, resulting in long-term population declines along with a decline in hunting participation. In recent years that decline appears to have slowed, with three of the last five years showing an increase in hunter participation at a statewide level. Increased participation in the 2020 season was likely due to the COVID-19 pandemic, which catalyzed increased participation in multiple forms of outdoor activities, including hunting. This boost in hunter numbers did not extend to the 2021 season. In 2021, an estimated 13,067 hunters pursued pheasant in eastern Washington (Figure 1), which is a 23% decrease from 2020 and 8% below the previous 10-year average. Over the past ten years, eastern Washington pheasant hunters each spent an average of 5 days afield. Hunters harvested an estimated 29,762 pheasants in 2021, a 37% decrease from 2020 and 30% below the previous 10-year mean.

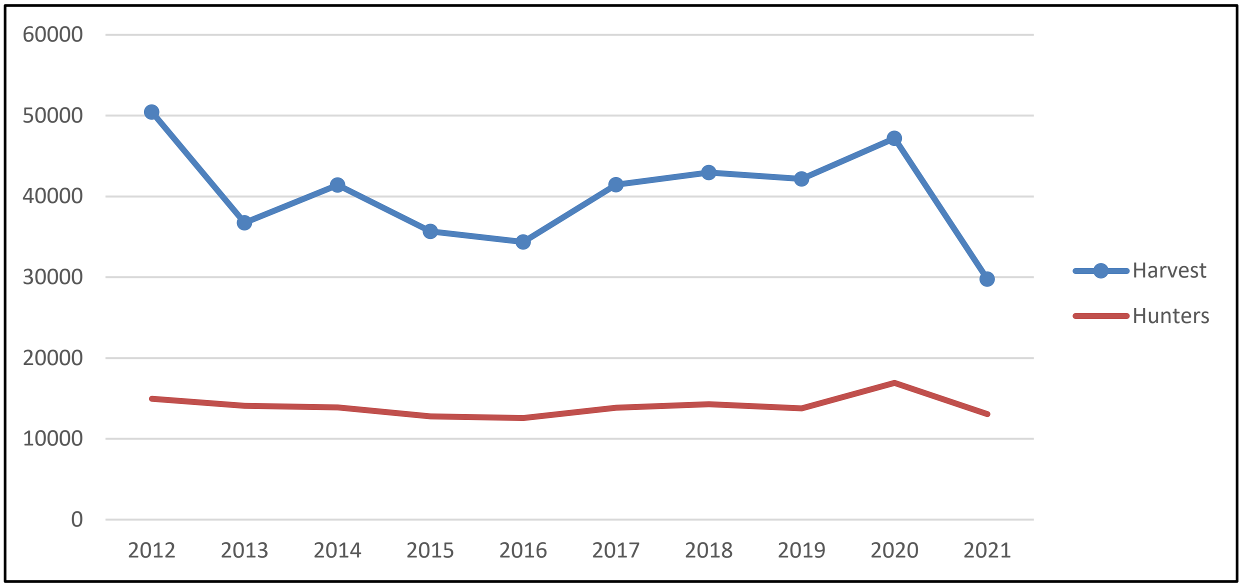

Figure 1. Estimated annual pheasant harvest (pen-raised and wild) and hunter participation in eastern Washington 2012-2021.

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 2021, WDFW released 9,598 pheasants in eastern Washington and is planning to release a similar number in the fall of 2022. 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.

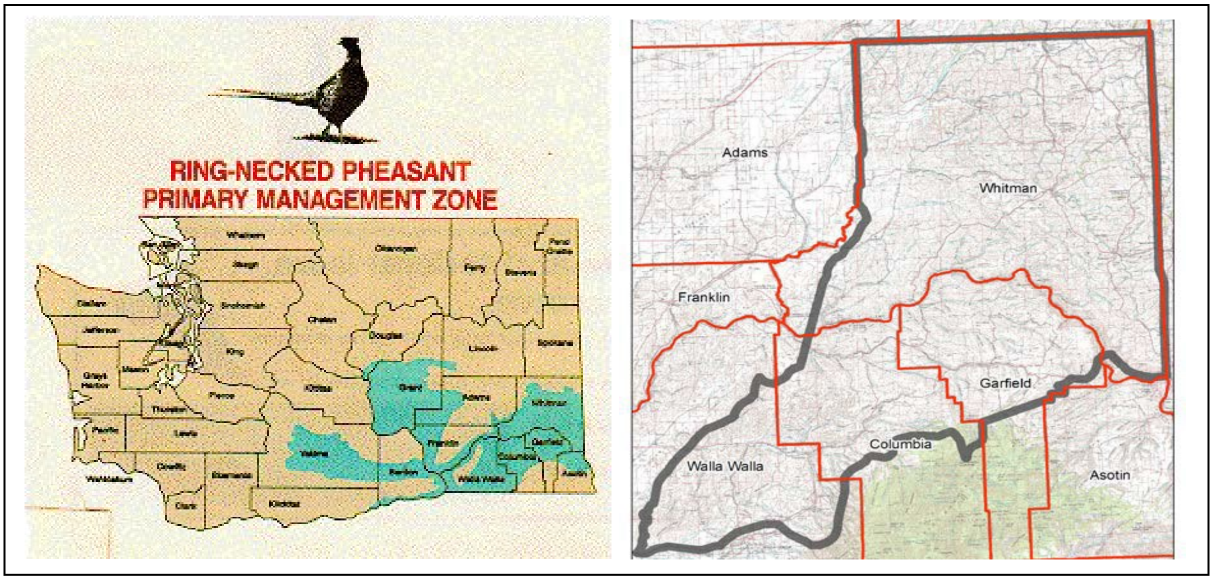

Figure 2: Washington state ring-necked pheasant primary management zone (left) and the southeast Washington Pheasant Focus Area (right).

Population Monitoring

In addition to long-term declines in pheasant harvest, crow counts and brood counts also declined during surveys in the primary management zone from 1982 through 1998. Though these are coarse measures of population trend, they suggest population declines in the range of 5-10% per year in that zone during that period (Rice, 2003). Rice (2003) found that crow and brood surveys were only likely to detect large population changes in the short term. Therefore, these surveys were not considered cost-effective and were discontinued.

North American Breeding Bird Survey (BBS) data also indicate population declines over the past three decades, with stabilization in the last 10 years (Figure 3; Sauer et al., 2020).

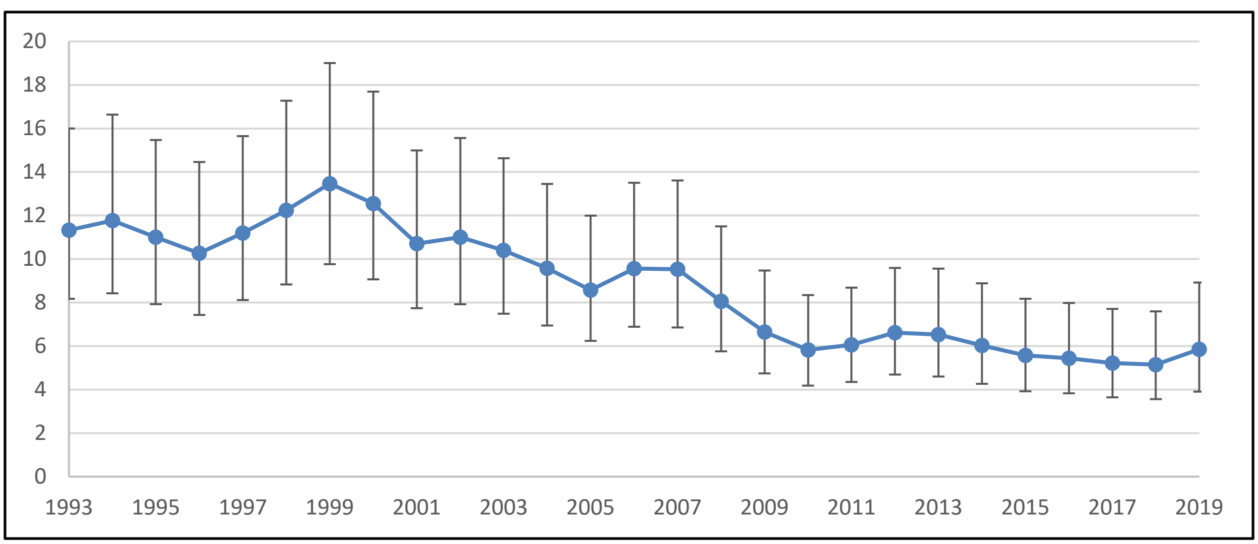

Figure 3. North American Breeding Bird Survey annual indices for pheasant in Washington, 1993-2019.

Harvest and hunter effort data can provide a coarse index to population trends. Standardizing harvest estimates by the amount of hunter effort expended to achieve that level of harvest can offer some indication of whether populations are increasing, decreasing, or stable. Harvest estimates for the Columbia, Snake River, and Yakima Basins have been used to monitor trends within the primary pheasant management zone.

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.

In all three basins, both the estimated number of harvests and days hunted decreased from 2020. In the Yakima River Basin, the relationship between days hunted and harvests remained constant between 2020 and 2021. In the Snake and Columbia River Basins, the decrease in harvests (42% and 36%, respectively) was greater than the decrease in days (23% and 32%, respectively). With some variation among years, days per harvest averages between 1 and 2 days in the Snake River Basin, just under two days in the Columbia River Basin, and just over two days in the Yakima River Basin (Figure 4).

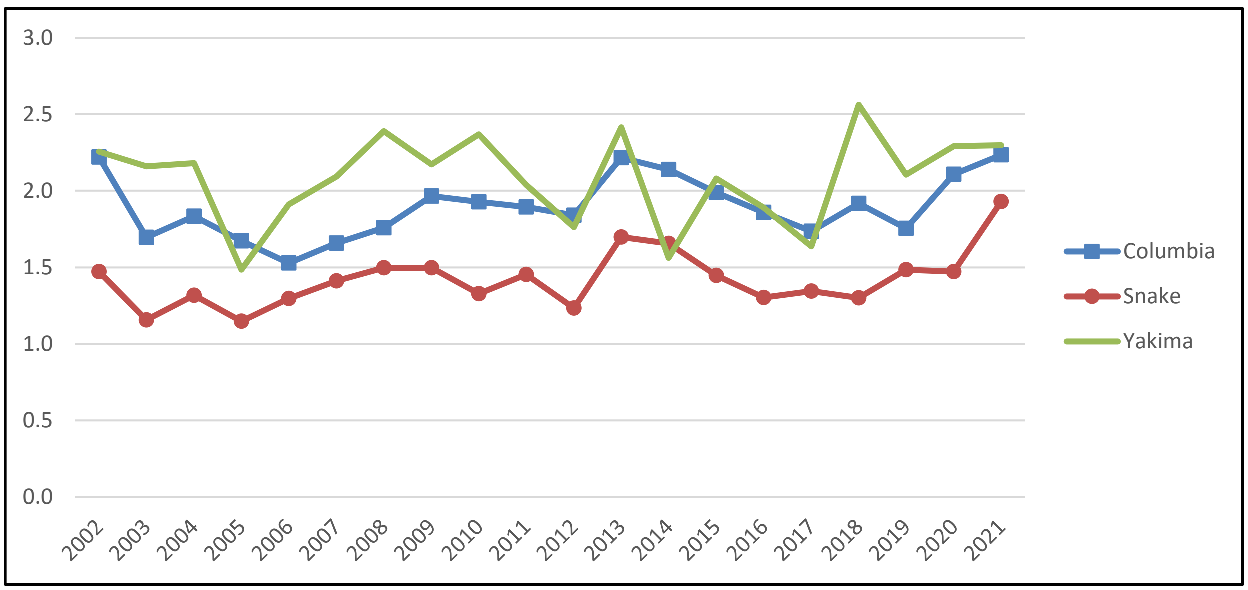

Figure 4. Estimated number of days hunted per pheasant harvest in each river basin, 2002-2021.

Spring of 2021 was unusually warm and dry, leading into a record-breaking heat wave in June that was likely detrimental to pheasant nesting and broods. This was followed by an extended drought season that likely limited forage throughout the summer and adversely impacted populations.

In 2019-2021, 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 routes in southeast Washington to contribute data to this project. Project objectives were to account for variable weather conditions during surveys and assess whether corrections may be applied to historical data to improve long-term monitoring. Researchers found that the detection probability of pheasant broods was 0.29 and was associated with volumetric soil moisture, wind speed, and dewpoint depression (Dienes, 2022). In a case study with Kansas data, Dienes (2022) determined that the survey methods tested (N-mixture models with survey replication) improved estimates of abundance but that traditional brood survey methods performed comparably in detecting population changes across years.

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 Washingtons pheasant habitat is heavily influenced by agriculture, and as a result, CRP is a critical component of 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 to install and enhance wildlife habitats. Private Lands biologists also assist with the 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). Neonicotinoids can impact pheasant survival and breeding reproduction (Sundall, 2020). 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. For example, recently hatched chicks are vulnerable to cold rains before they are sufficiently feathered. Still, 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. Even with normal temperatures, early spring drought conditions may decrease insect availability. A large portion of pheasant chick diets consists of calorically dense, high-protein insects (Savory, C. J., 1989).

Management Conclusions

Harvest and historical survey data indicate that eastern Washington pheasant populations and hunter participation have experienced a long-term decline. Recent harvest data indicate that population declines may be stabilizing, though these data only allow for coarse interpretation, and more rigorous surveys would be beneficial. It is not fully understood whether limitations on hunting access, economic changes, or other factors might be playing a role in declining hunter participation. Maintaining hunters who were either new or reactivated in the 2020 season will be important for addressing this trend.

Causes for the population declines are not clearly understood, but habitat loss and land use changes are likely primary drivers. 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.

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Chukar
and
Gray Partridge

Chukar and Gray Partridge Status and Trend Report

STATEWIDE

SARAH GARRISON, Statewide Small Game 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 through 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 region. 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 on October 1 and ended the second Sunday in January. The season changed again in 2003, spanning the first Saturday of October through mid-January, which remained in effect through the 2020 season. The 2021 chukar season was extended to the end of January, while the gray partridge season remains unchanged. 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.

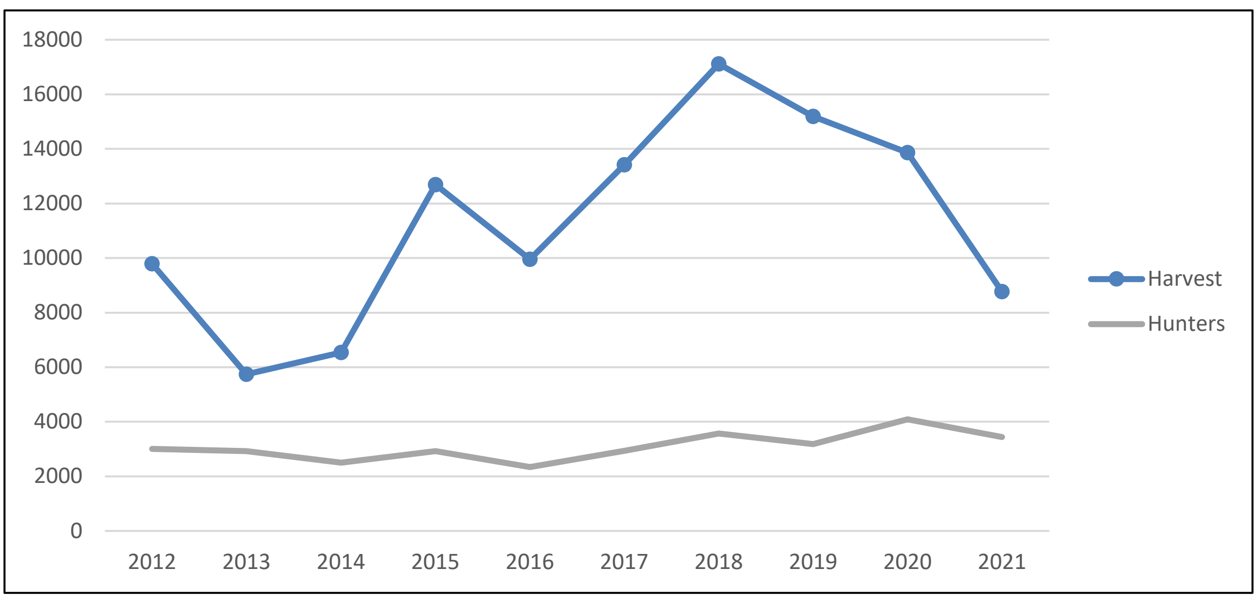

Figure 1. Estimated statewide chukar hunters and harvest, 2012 – 2021.

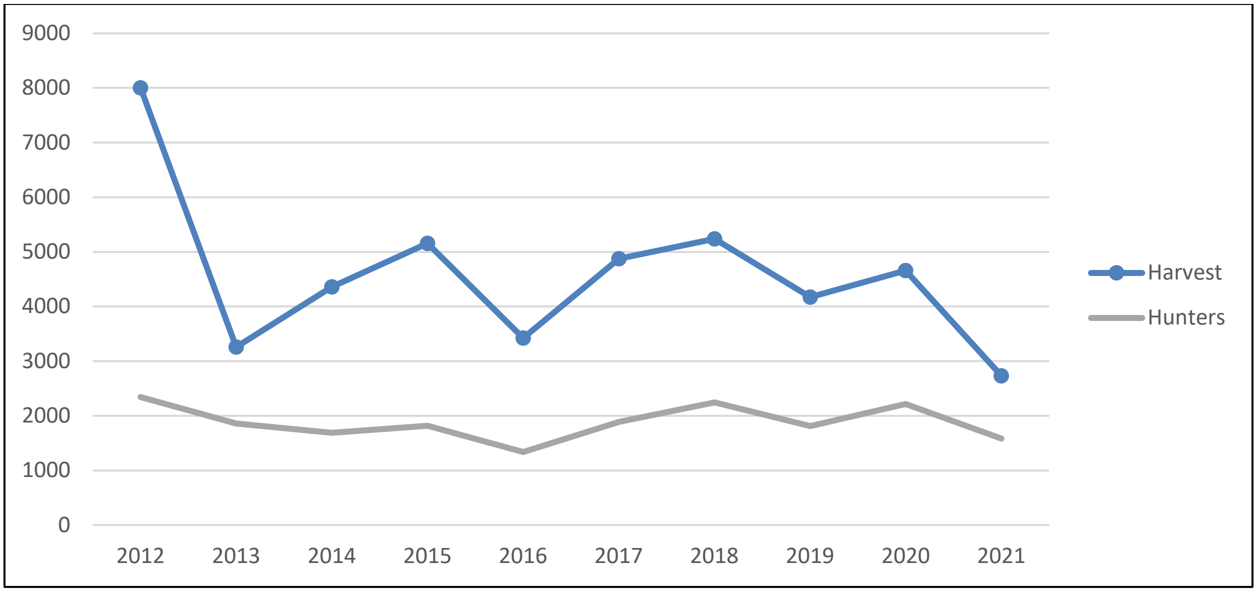

Figure 2. Estimated statewide gray partridge hunters and harvest, 2012 – 2021.

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 1970s, hunter participation and harvest steadily declined. Harvest and hunter participation have been estimated based on a survey mailed to a stratified random sample of 25,000 hunters for the past two decades.

Increased hunter participation in the 2020 season, likely due to the COVID-19 pandemic, did not hold for the 2021 season. Despite the decline, chukar hunter numbers remain above the previous 10-year average. In 2021, an estimated 3,442 hunters pursued chukar while 1,585 pursued gray partridge (Figures 1 and 2), a 16% decrease in chukar hunters since 2020 but remains above the previous 10-year average of 3,073 hunters. Chukar harvest, estimated at 8,764, declined 37% from 2020 and fell below the previous 10-year average of 11,607 chukars. Gray partridge hunters decreased 28% and harvests decreased 41% from 2020, falling below the previous 10-year averages.

Population Monitoring

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. Standardizing harvest estimates by the amount of hunter effort expended to achieve that level of harvest can provide some indication of whether populations are increasing, decreasing, or stable.

Despite long-term declines in the total number of chukar harvested, the number of chukar harvested per hunter shows no increasing or decreasing trend since 1984 (Figure 3). The long-term average number of harvests per hunter is between 3 and 4 birds. Similarly, the number of gray partridge harvested per hunter has been relatively stable since 1997, averaging between 2 and 3 birds (Figure 3). However, a decreasing trend in the past five years suggests closer monitoring may be warranted.

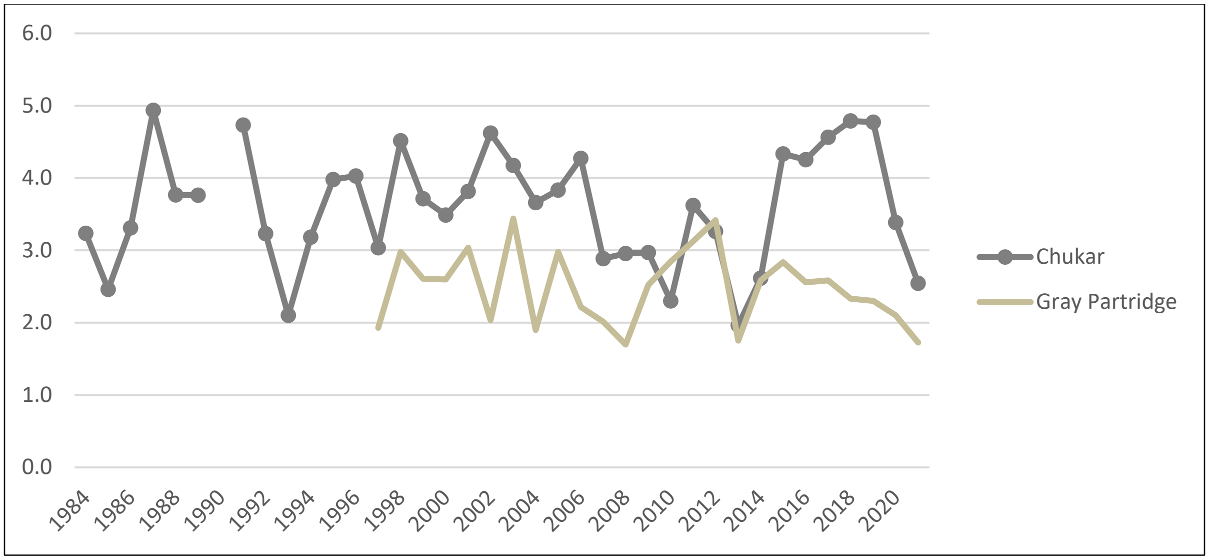

Figure 3. Estimated number of chukar (1984-2021) and gray partridge (1997-2021) harvested per hunter.

Spring of 2021 was unusually warm and dry, leading into a record-breaking heat wave in June that was likely challenging for broods. This was followed by an extended drought season that likely limited forage throughout the summer and adversely impacted populations.

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 development. Cheatgrass is a staple of the chukar diet during spring and fall, and the availability of cheatgrass can significantly impact their populations. Encroachment of invasive plants such as yellow star-thistle (*Centaurea solstitialis*), combined 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. Therefore, 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.

The 2021 wildfire season, though severe, saw fewer large fires in chukar and gray partridge habitat than in 2020.

Management Conclusions

Chukar and gray partridge populations in Washington have declined from the highs of half a century ago. These long-term declines are likely due to diminishing habitat quality. For example, the invasion of yellow star-thistle has taken over thousands of acres of quality habitat in southeastern Washington, reducing available food resources for chukars. Habitat quality in some portions of the state may have actually improved in recent years 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.

Chukar and gray partridge populations can be expected to fluctuate annually in response to weather variability and associated habitat quality. A continued focus on habitat enhancement should benefit these populations into the future.

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Quail

Quail Status and Trend Report

STATEWIDE

SARAH GARRISON, Statewide Small Game Specialist

Management Guidelines and Objectives

Three species of quail occur in the wild in Washington. California quail (*Callipepla californica*) is the most abundant, while northern bobwhite (*Colinus virginianus*) occurs in low numbers remnant from past releases. Mountain quail (*Oreortyx pictus*) persists in small populations in its native eastern Washington habitats where hunting is closed and also occurs in introduced western Washington populations. The objectives for quail in Washington are to maintain healthy, sustainable populations in all suitable habitats within the state and to maximize recreational opportunities, as outlined in the Game Management Plan (WDFW, 2014). In the case of mountain quail, 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 & Bishop, 2009), which was collaboratively produced through the Association of Fish and Wildlife Agencies.

Hunting Seasons and Recreational Harvest

In eastern Washington, the general hunting season for California quail and northern bobwhite was open 108 days from 2 October 2021 through 17 January 2022. A special youth-only hunting weekend occurred on 18 and 19 September. The general season has a mixed bag limit of 10 per day with a possession limit of 30. In western Washington, the general season for California quail, bobwhite quail, and mountain quail ran 67 days from 25 September through 30 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.

Harvest, number of quail hunters, and number of days hunted are estimated based on a survey for multiple small game species mailed to a stratified random sample of 25,000 hunters. This survey collects data for all quail species combined. The vast majority of quail harvested are California quail, so harvest data are most useful for inferences about California quail populations and have limited utility for monitoring other quail species.

Participation in quail hunting has declined over the long term. In 2021, an estimated 8,950 hunters pursued quail (Figure 1), an 18% decrease in participation from 2020 and 8% below the previous 10-year average. An estimated 45,141 quail were harvested in 2021, which is a 32% decrease from 2020 and 39% below the previous 10-year average. More than 99% of the statewide total harvest occurred in eastern Washington in 2021, which is consistent with past years.

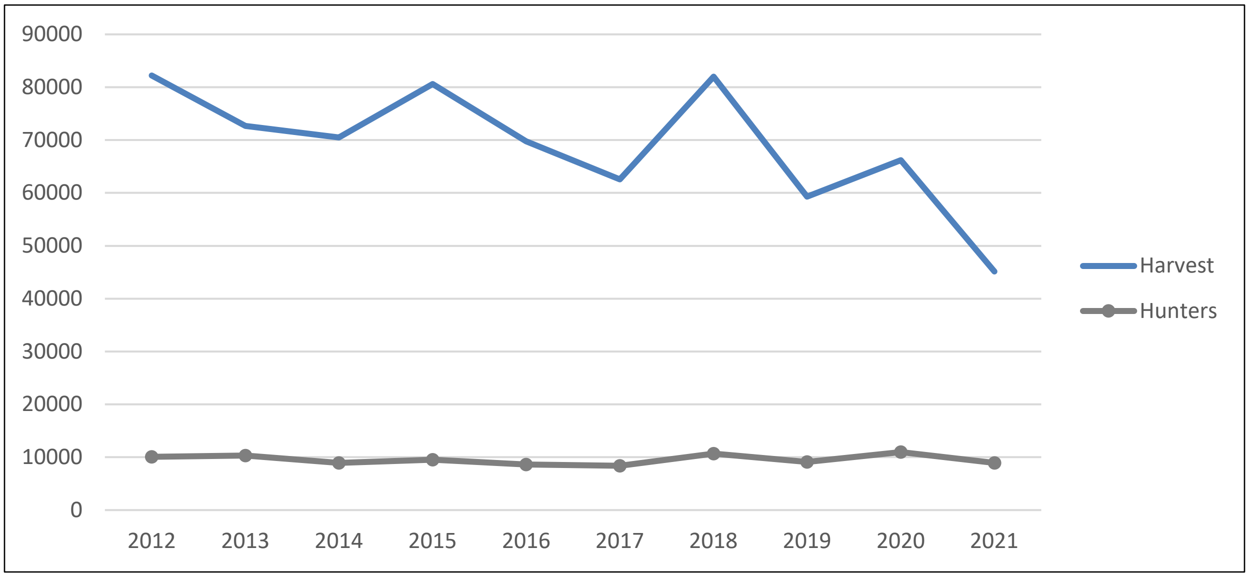

Figure 1. Estimated quail harvest and hunter participation, 2012-2021.

Population Monitoring

All population and production surveys were discontinued in 1999 due to limited time and funding for district biologists. Harvest and hunter-effort data are used as an index to population trends. Based on harvest, quail populations in Washington appear much lower than they were half a century ago when statewide harvest exceeded 200,000 quail. This long-term decline is most likely related to "clean" farming practices introduced in the early 1980s that encouraged the removal of shrubby cover along fence lines and draws. In addition, the decline in harvest is related to a decline in hunter participation. To account for this, the number of quail harvested per hunter can serve as an alternative index to population trends. Standardizing harvest estimates by the amount of hunter effort expended to achieve that level of harvest can provide some indication of whether populations are increasing, decreasing, or stable.

The number of quail harvested per hunter has declined slightly over the past two decades, from an average of 8-9 quail per hunter in the 2000s to an average of 7-8 quail per hunter in the 2010s (Figure 2). In 2021, the average number of harvests per hunter, estimated at 5, was 30% below the 10-year average.

The breeding bird survey (BBS, US Geological Survey) information for Washington suggests an increasing trend for California quail populations over the last three decades (1993-2019, Sauer et al. 2020, Figure 3). Analysis results from recent years are not yet available.

Quail populations are highly dependent on weather, causing high annual variability. Spring of 2021 was unusually warm and dry, leading to a record-breaking heat wave in June that was likely challenging for broods. This was followed by an extended drought season that likely limited forage throughout the summer and adversely impacted populations.

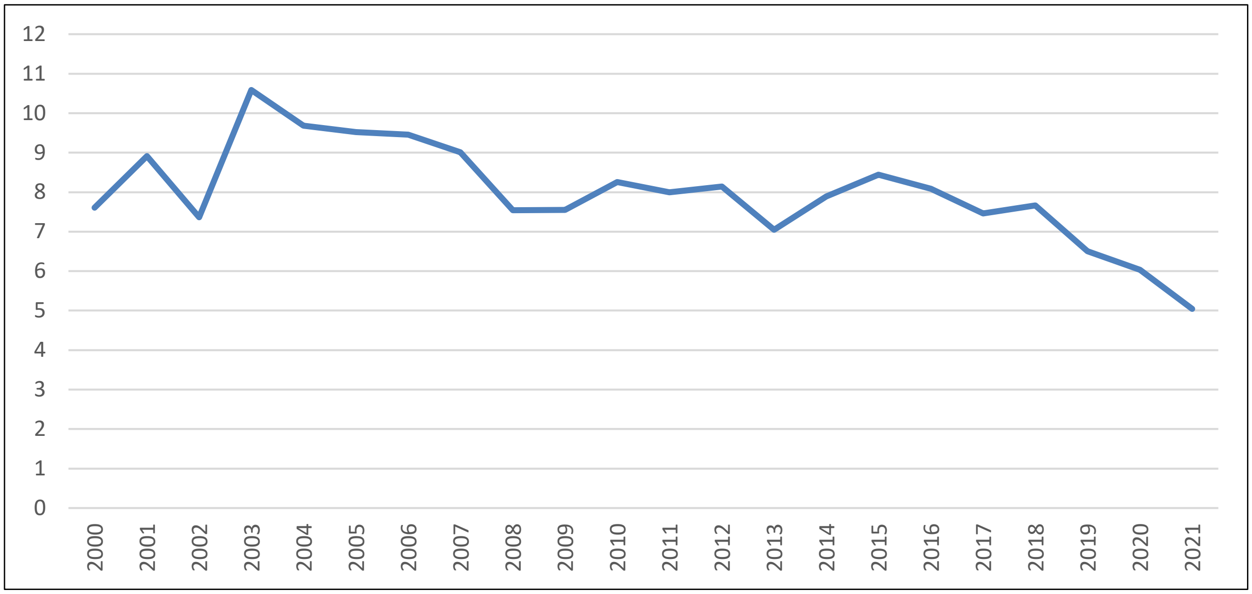

Figure 2. Estimated number of quail harvested per hunter, 2000-2021.

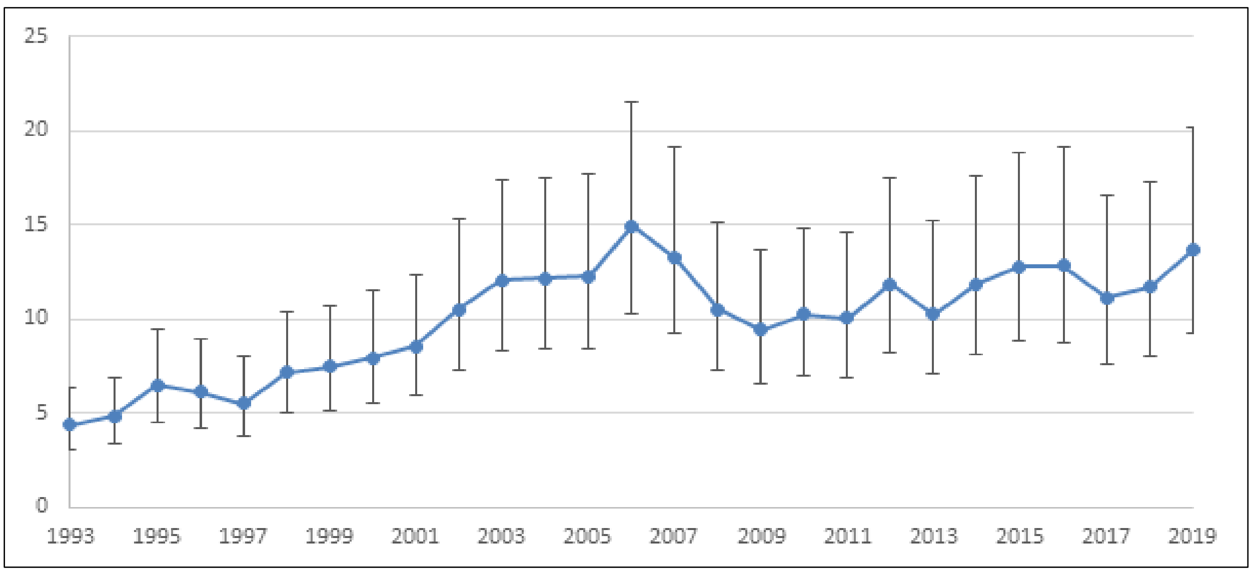

Figure 3. BBS annual indices for California quail, 1993-2019.

Habitat

As with other agriculturally associated wildlife, quail habitat quantity and quality have declined 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. As a result, land development and "clean" farming practices have dramatically reduced and fragmented suitable habitats 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’s 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 limit 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 benefit 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. The continuation of these programs is vital for enhancing upland bird habitat in eastern Washington.

Mountain Quail 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 thesis (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 mountain quail's small, dispersed populations are not cost effective. Therefore, it is difficult to assess whether the augmentation effort was successful in reestablishing a viable population. Before any further releases, a full evaluation of the reintroduction effort will need to occur. In addition, WDFW has initiated a contract with Washington State University (WSU) for a five-year research project to inform the future management of these mountain quail populations. Results from this research will be available in 2026.

Management Conclusions

Quail are an important upland game bird species and of significant interest to wildlife enthusiasts. 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 helped to reestablish a viable population or whether alternative strategies are needed. Habitat enhancements may be needed in conjunction with future releases or as a next step in the recovery effort. Improved survey methods would be valuable in informing needs and areas of focus. The research contracted through WSU will provide critical information regarding mountain quail status, limiting factors, and habitat use to guide management decisions.

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Grouse

Forest Grouse Status and Trend Report

STATEWIDE

SARAH GARRISON, Statewide Small Game 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*). Dusky and sooty grouse were considered a single species, blue grouse, in the past and are still colloquially referred to as blue grouse today. 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 various 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 forest grouse hunting season was open September 1st to December 31st since 1973. In 2020, the Fish and Wildlife Commission approved changing the grouse season to September 15th through January 15th, beginning with the 2021 season. Delaying the start of the season by two weeks (without reducing the total season length) is intended to increase grouse abundance and availability to hunters by protecting breeding-aged females (hens) while they are still caring for their broods. Forest grouse broods typically become independent of the hen in mid-September. In the early season, before broods break up, hens appear at higher risk of harvest than breeding-aged males based on hunter-submitted wing and tail samples. Increasing hen survival should lead to an increase in population abundance and hunter opportunity.

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 due to 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 detrimentally impact populations. 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, the number of grouse hunters, and the number of days hunted are estimated based on a survey for multiple small game species mailed to a stratified random sample of 25,000 hunters. This survey has been in place since 2001. Developing estimates of forest grouse hunter effort and harvest is challenging due to the licensing structure, which impacts hunter sample stratification by allowing forest grouse harvest with either a big game or small game license.

Participation in grouse hunting has declined from historic highs in the 1970s when an average of 112,000 hunters pursued grouse each year. More recently, the number of hunters dropped sharply between 2010 and 2012. Since then, annual changes have been less than 10% (Figure 1). On average, each hunter spends about 8 days hunting grouse in a season. In 2021, an estimated 20,390 hunters pursued grouse for an estimated 152,542 days. This is a 9% decrease in hunters from the 2020 season and 9% below the previous 10-year average. Harvest also decreased in 2021 to an estimated 39,943 grouse harvested statewide. This is 17% below 2020 harvests and 27% below the previous 10-year average.

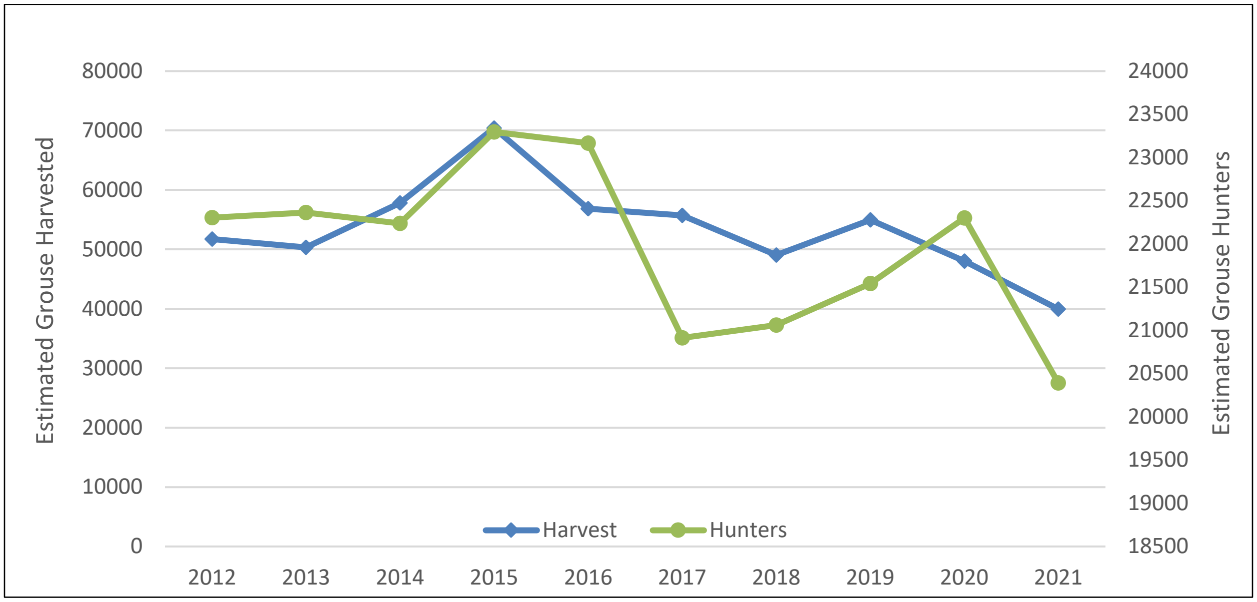

Figure 1. Estimated forest grouse harvest and hunter numbers, 2012-2021.

Estimated hunter participation decreased from 2020 levels in all regions except for the Southwest Region, where participation remained constant. Participation decreased the most in the North Puget Sound Region (26%), followed by the North Central (19%), South Central (12%), Coastal (7%), and Eastern (4%) regions. For a map of WDFW Regions, see wdfw.wa.gov/about/regional-offices.

Population Monitoring

WDFW has not developed survey methods to estimate forest grouse abundance. Instead, harvest and hunter-effort data are used as an index to population trends. This is done by standardizing harvest estimates by the amount of hunter effort expended to achieve that level of harvest.

Harvests per hunter have declined from historic highs half a century ago, indicating that the decline in total harvests may not solely be due to declining hunter effort (Figure 2). Though only available through 1985, harvests per day follow a similar slow downward trajectory. While it is unclear to what extent this downward trend might be cause for concern, it does clarify a need for continued and closer monitoring. In examining these data, it is important to note that over the years, changes in bag limits, seasons, and survey methods (1984, 1998-2001) have impacted the interpretation of long-term trends.

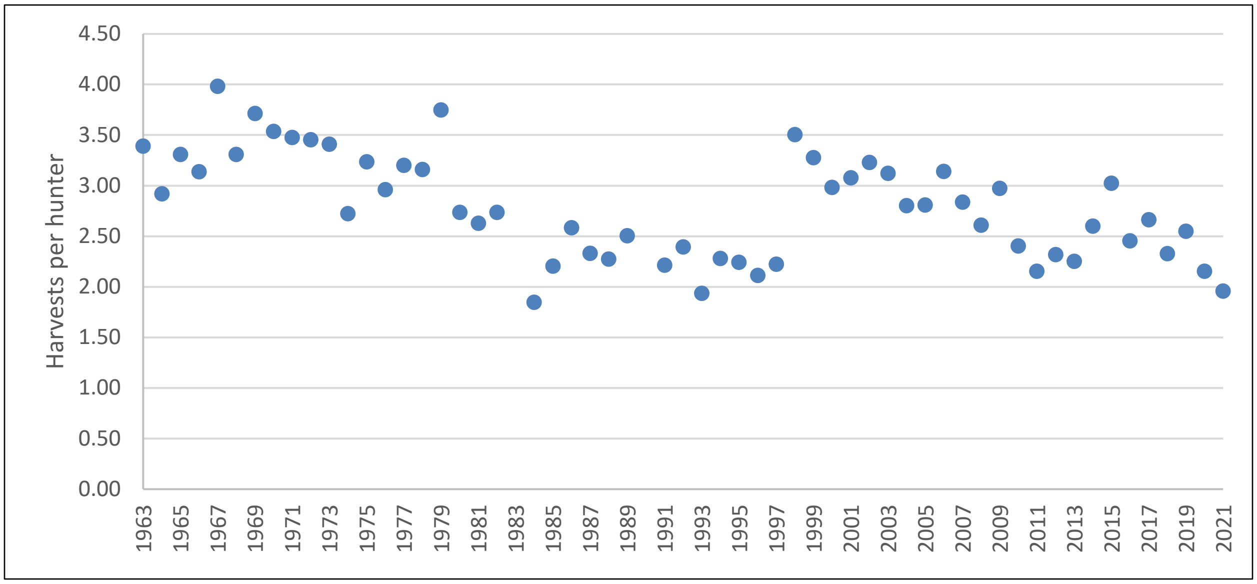

Figure 2. Estimated number of grouse harvested per hunter in Washington 1963-2021. Note that survey methods changed in 1984 and 1998-2001.

Samples collected from grouse hunters provide an additional metric for monitoring forest grouse population trends. A wing and tail from a harvested grouse can provide the information necessary to identify the species, sex, and age of the bird. For more information about voluntary collections from hunters, see wdfw.wa.gov/hunting/requirements/upland-birds/grouse-wing-tail-collection. Forest grouse wings were collected in north-central Washington between 1993 and 2014, when collections ended 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 into all six WDFW Regions. In 2020, zones were established to guide future sampling efforts and analysis (Figure 3).

Species composition data are lacking from the hunter harvest survey, which groups all forest grouse species into a single category. Wing and tail collections have shown that of 5,777 samples from 2016 – 2021, 49% are dusky or sooty grouse, 44% are ruffed grouse, and 8% are spruce grouse (Table 1).

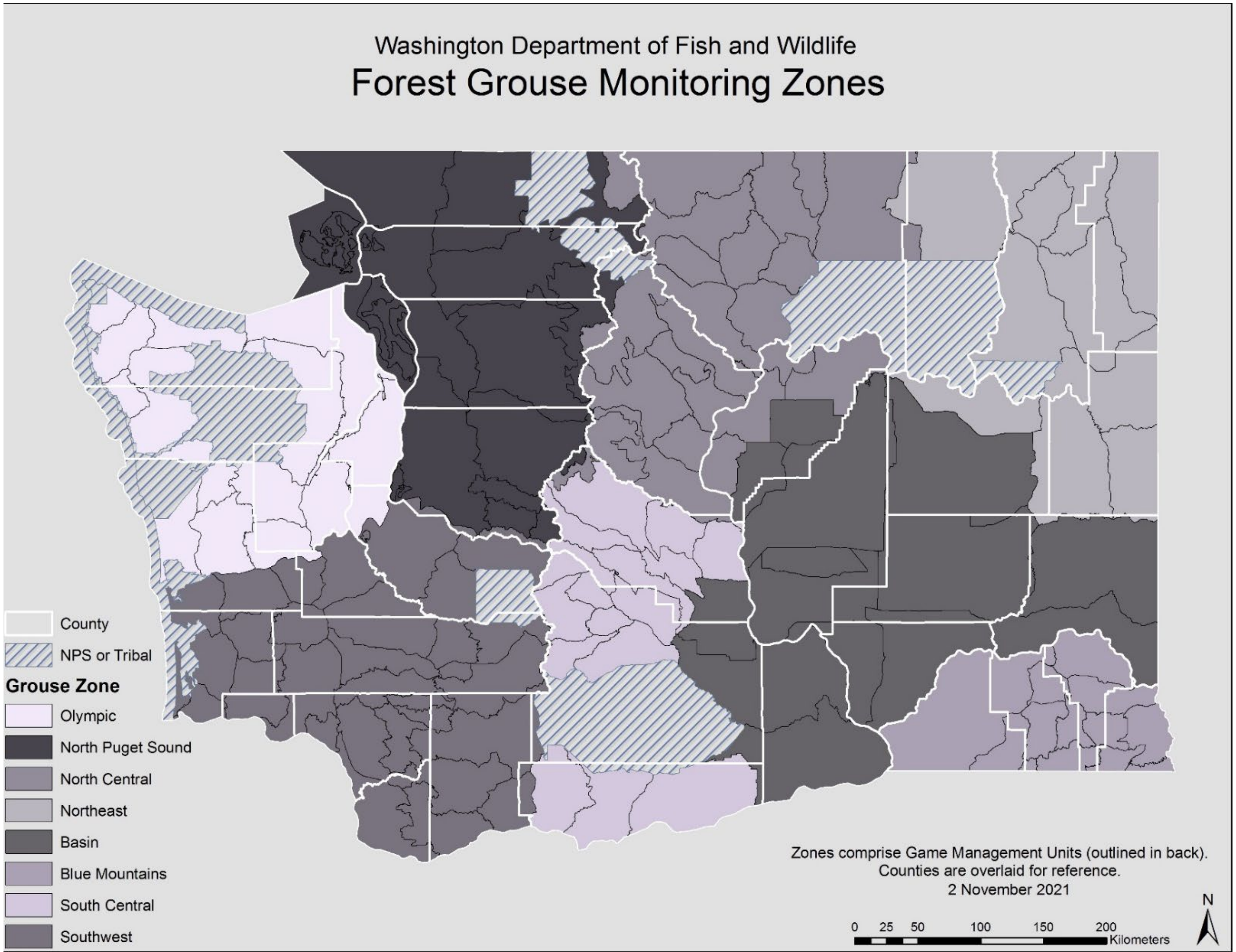

Figure 3. Map of forest grouse monitoring zones delineated in 2020 to guide future sample collection and analysis.

Table 1. Number of forest grouse sample collections by zone, 2016–2021. Blue includes both sooty and dusky grouse. A sample consists of either a wing or a wing-tail pair.

Zone	Year	BLUE	RUFFED	SPRUCE	UNKNOWN
Blue Mountains	2016	0	0	0	0
Blue Mountains	2017	1	2	0	0
Blue Mountains	2018	0	0	0	0
Blue Mountains	2019	0	0	0	0
Blue Mountains	2020	26	11	0	0
Blue Mountains	2021	0	0	0	0
North Central	2016	203	90	56	0
North Central	2017	307	82	69	0
North Central	2018	265	56	46	0
North Central	2019	216	84	29	1
North Central	2020	221	55	56	0
North Central	2021	95	53	36	0
North Puget Sound	2016	0	0	0	0
North Puget Sound	2017	0	0	0	0
North Puget Sound	2018	0	0	0	0
North Puget Sound	2019	6	35	0	0
North Puget Sound	2020	73	95	2	0
North Puget Sound	2021	48	78	0	0
Northeast	2016	11	118	19	0
Northeast	2017	17	162	11	0
Northeast	2018	13	104	28	0
Northeast	2019	23	88	29	0
Northeast	2020	20	113	43	0
Northeast	2021	30	147	11	0
Olympic	2016	10	22	0	0
Olympic	2017	103	66	0	0
Olympic	2018	74	26	0	0
Olympic	2019	71	102	0	0
Olympic	2020	62	81	0	0
Olympic	2021	66	85	0	0
South Central	2016	71	19	0	0
South Central	2017	156	24	0	0
South Central	2018	102	48	0	0
South Central	2019	98	26	1	0
South Central	2020	3	4	0	0
South Central	2021	26	8	0	0
Southwest	2016	2	1	0	0
Southwest	2017	0	0	0	0
Southwest	2018	112	121	0	0
Southwest	2019	84	177	0	0
Southwest	2020	78	144	0	0
Southwest	2021	42	146	0	0
Unknown	2016	0	0	0	0
Unknown	2017	0	2	0	0
Unknown	2018	37	20	0	0
Unknown	2019	21	26	0	0
Unknown	2020	2	8	0	0
Unknown	2021	9	8	0	0

Analysis of wing collection data from 1993-2008 showed a significant decline in hunting pressure throughout the first month of the hunting season (Schroeder, 2010). Therefore, current seasons that extend into January probably have minimal impact on grouse populations in the later months. Data from recent collections support this, with 35% of 2016-2020 samples harvested in the first two weeks of September.

Age data obtained from wing samples (proportion of juveniles relative to adults) can serve as an index to monitor trends in productivity of the forest grouse population. Hansen et al. (2011) found that age ratios from the first two weeks of the season in early September were the best index to annual reproduction for forest grouse, because ratios of juvenile grouse to adult grouse declined over the season in their study. Last year's report (WDFW, 2021) showed the proportion of juveniles in harvested samples from September 1-15th, 2016-2020. Because the 2021 season opened on September 15th, these data are unavailable for this year. Unlike Hansen et al. (2011), Washington's data from 2016 to 2021 do not show consistent declines in juvenile-to-adult ratios through the season. Due to this lack of downward trend and the lack of early September data in 2021, the proportion of juveniles in the harvest is reported for the full season of each year to serve as a productivity index (Figure 4 and Table 2). For all species, the proportion of juveniles increased in 2021.

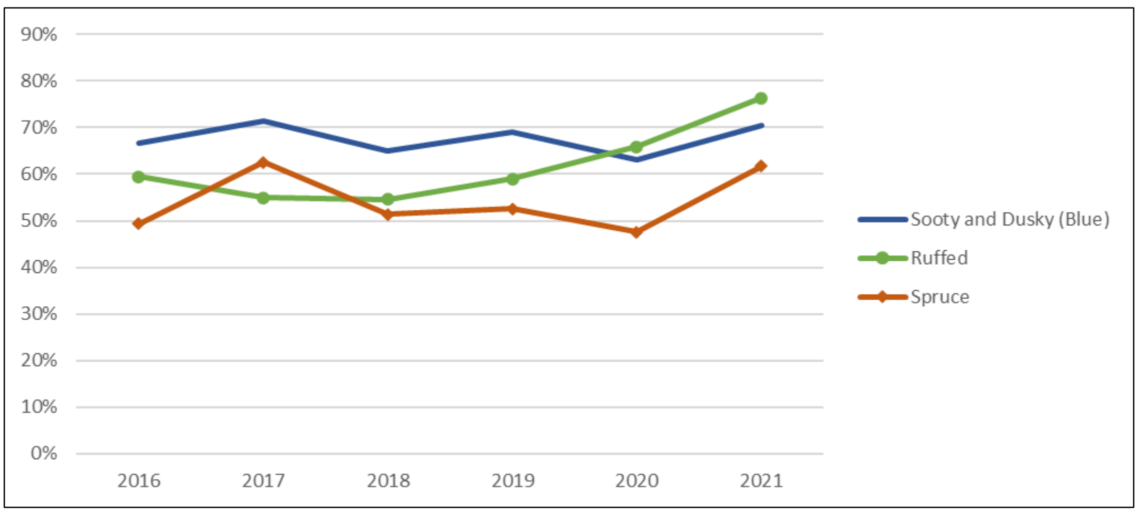

Figure 4. Proportion of juveniles relative to breeding-aged (adult) forest grouse in wing and tail samples submitted by hunters, 2016-2021. Data are included from the full season of each year (2016-2020: 1 Sep. to 31 Dec. and 2021: 15 Sep. to 15 Jan.).

Breeding-aged females are an important demographic when monitoring the productivity of a population. For sooty, dusky, and spruce grouse, a wing sample is sufficient for identifying sex; however, for ruffed grouse, both a wing and a tail are required. Due to low submissions of tails from hunters, sex data for ruffed grouse are limited. For dusky and sooty grouse, sex ratios are consistently skewed towards females. However, 2016-2020 data showed a notable decrease in females from the early part of the season (1-15 Sep.) compared to the full season (WDFW, 2021). Schroeder (2010) found a similar pattern with longer-term data in Okanogan County. Among blue grouse (mostly dusky), the sex ratio was 1.76 females:male during the first half of September and 1.04 females:male during the rest of the season. Among breeding-age spruce grouse, the sex ratio was 2.01 females:male during the first half of September and 0.80 females:male during the rest of the season. This indicates a disproportionate vulnerability of females to harvest during early September before broods have broken up. With the delayed season starting in 2021, the proportion of females in the harvest among dusky and sooty grouse dropped to the lowest value on record (52%, Figure 5).

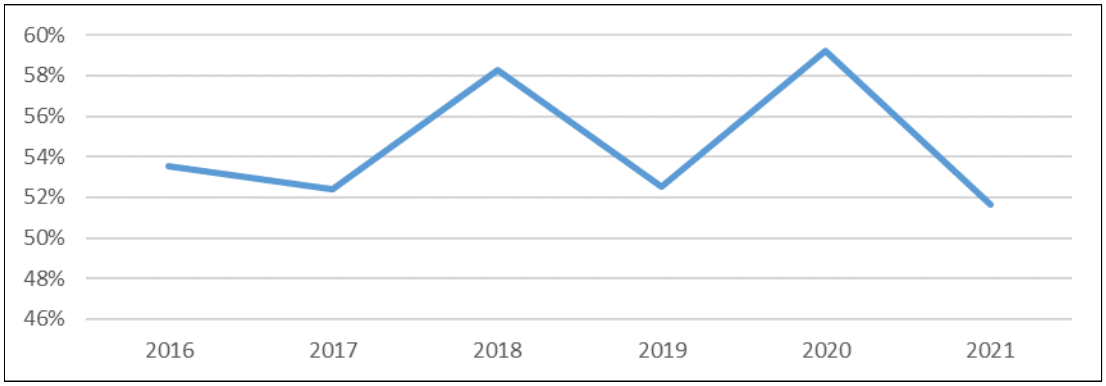

Figure 5. Proportion of females relative to males of breeding-aged (adult) dusky and sooty grouse in wing and tail samples submitted by hunters, 2016-2021. Data are included from the full season of each year (2016-2020: 1 Sep. to 31 Dec. and 2021: 15 Sep. to 15 Jan.).

Table 2. Sex and age ratios of harvested forest grouse from wing and tail collections, 2016-2021. Blue denotes both sooty and dusky grouse. Data are included from the full season of each year (2016-2020: 1 Sep. to 31 Dec. and 2021: 15 Sep. to 15 Jan.). Adults are breeding age (yearling or older); juveniles are young-of-year. Where sample size is insufficient (<30), results are not applicable, indicated by NA. Ruffed grouse cannot be identified by sex without a tail sample. Since tail submissions are few, sex-based metrics for ruffed grouse are excluded, indicated by NA.

Year	Species	Breeding age (adult)			JUVENILE	ADULT	% JUVENILE	JUVENILE: ADULT FEMALE
		FEMALE	MALE	% FEMALE				
2016	BLUE	53	46	54%	197	99	67%	3.7
2017	BLUE	87	79	52%	415	166	71%	4.8
2018	BLUE	123	88	58%	391	211	65%	3.2
2019	BLUE	84	76	53%	357	160	69%	4.3
2020	BLUE	106	73	59%	306	179	63%	2.9
2021	BLUE	48	45	52%	221	93	70%	4.6
2016	RUFFED	9	7	NA	148	16	59%	NA
2017	RUFFED	25	11	NA	185	36	55%	NA
2018	RUFFED	12	22	NA	204	34	55%	NA
2019	RUFFED	41	46	NA	313	87	59%	NA
2020	RUFFED	39	70	NA	336	109	66%	NA
2021	RUFFED	36	29	NA	397	65	76%	NA
2016	SPRUCE	22	16	58%	37	38	49%	1.7
2017	SPRUCE	18	12	60%	50	30	63%	2.8
2018	SPRUCE	20	15	57%	38	35	51%	1.9
2019	SPRUCE	11	17	NA	31	28	53%	2.8
2020	SPRUCE	31	22	58%	48	53	48%	1.5
2021	SPRUCE	12	6	NA	29	18	62%	2.4

Habitat

Forest management and wildfire are the most significant factors influencing habitat conditions and habitat losses for forest grouse populations statewide. Historically, timber harvest activities have been considered beneficial for most forest grouse species. Changes to silviculture techniques, such as using herbicide to control broadleaf species, considered essential 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 how regenerating forests are managed. Regeneration techniques that include extensive broadleaf 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 early 1990s. Early successional shrub communities resulting from these fires will benefit grouse for several years, but the loss of mature forest stands essential to winter survival may offset this benefit.

Supplementation of forest grouse populations is generally considered unnecessary in Washington. No large-scale efforts have been made to enhance habitat specifically 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

The effect of spring weather on chick production and survival is a well-known factor influencing variation in populations across regions and years. 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. Conversely, drought conditions can also reduce forage opportunities. This may have been the case in 2021, when a severe heat wave in June led into an extended drought season over the summer. Loss or changes in forest habitat may also affect populations and harvest opportunities.

Many factors influence forest grouse harvest, which historically has been used as the primary population status indicator. A decline in hunter success rates indicates that the decline in harvest may be more than just a result of declining hunter participation. The collection of grouse wings and tails provides some insights into population structure. Though the proportion of juveniles in the harvest from 2016 – 2020 was within the range documented by Schroeder (2010), hen vulnerability to harvest in early September may have been a factor limiting production, especially in the areas most accessible to hunters. The delayed season start date in 2021 appears to have reduced the proportion of hens in the harvest. Continued monitoring will improve our understanding of population trends in light of this change.

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Private Lands Access

Private Lands Access Status and Trend Report

STATEWIDE

OTTIE M. HOLCOMB MCCLELLAN, Acting Private Lands Access Program Manager

Introduction

The Department's Private Lands Program promotes cooperation with landowners across the state to provide public access to private property while emphasizing hunting, fishing, wildlife viewing, endangered species conservation, and habitat enhancement. One of the top goals is to encourage landowners to provide public access while addressing the costs that landowners incur when allowing the public on their property. Various incentives are available to landowners depending on the property location, habitat(s), and current property management. These incentives include monetary payments, land/habitat improvements, hunter management strategies, or Farm Bill technical assistance. In addition, the Private Lands Biologists assist the landowners through this process by serving as the program specialists for both the Private Lands and the Federal Farm Bill programs.

Several funding sources help fund the current private lands program. The work conducted within the private lands program is vast and aids in acquiring various funding sources, including both state and federal funding. The majority of current funding comes from the following sources: USFWS Pittman Robertson (PR) funds, State General Fund, species-specific funds from hunting license sales, funding from the Natural Resources Conservation Service (NRCS) through the Voluntary Public Access, and the Habitat Incentive Program (VPA-HIP) Grant. The latter provides the most operational funding for the Private Lands Program over three years. Access to the VPA-HIP funding ends in May 2023 and is currently under review by NRCS for a one-year extension. WDFW leadership is actively pursuing additional funds to keep the program fully funded for 2023-2024. Much of this report will address the specific objectives within the VPA-HIP grant and the program's future direction. It is important to note that the program's success relies on partnerships with private landowners, sportsman's groups, and volunteers. In addition, Washington has several unique challenges regarding public access to privately owned land. The program is constantly changing and adapting new ways to serve both private landowners and the public.

Management Guidelines and Objectives

Most enrolled landowners have a formal agreement with the Department; however, some industrial timber managers and large land parcel owners often work closely with field staff to facilitate public access for hunters without formal agreements.

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.

- ***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 must 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.

- ***Hunt by Reservation*** – This component of the private lands program began in 2013. It is attractive to many landowners and organizations because it allows access to specific reservation and hunter information via a landowner portal. Management of the Hunt by Reservation program operates through an online registration system where hunters create an account to reserve available properties. The Hunt by Reservation program allows landowners to manage hunting on their lands without direct contact with hunters.

- ***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 possessing 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.

- ***Landowner Hunting Permit (LHP)*** – This includes private lands where WDFW negotiates public hunting access to unique opportunities that otherwise would not exist. A formal application process occurs every three years along with the 3-year season setting cycle. Landowners must apply, qualify, gain acceptance by the program and regional staff, and then be approved by the Wildlife Commission before being considered an LHP Landowner. Once the Commission approves, landowners will work with regional WDFW staff to set customized hunting season opportunities on their property. During the three years, landowners must follow the standard operating procedure for the LHP Program and provide annual reports. These opportunities are also advertised annually in the Big Game Hunting Regulations and are open to the public by special permit.

In early 2018, WDFW determined that the current software system containing the private lands data and information could no longer meet the program's growth and public needs. The Department has plans to migrate the current system and the corresponding program data into a new and improved platform maintained through a centralized system. There have been several hurdles that have prevented this new system from being built. The system requirements are extraordinarily intricate and involve numerous divisions within WDFW. This, combined with the expected cost of production, has presented WDFW with numerous challenges. In 2020, during the latter part of the initial development phase, the total estimated costs of implementing a new system exceeded what funds were available to the Department at that time. Investigations into new funding sources and a phased-approach rollout are happening now. As the Department moves out of the initial development phase and searches for other funding sources, staff continue to document and identify all necessary system requirements and upgrades. The current system is both beneficial and a source of frustration for users and continues to work hard to move forward with implementing a new system. WDFW anticipates that the new system should be in production by Fall 2023.

In 2018, the Department introduced an initiative that focused on developing strategies to work with large industrial timber companies to acquire access for hunting and other forms of outdoor recreation. The Department constantly examines existing timber company relationships and analyzes areas with limited private land access. After the 2022 hunting season, the Department successfully acquired more than 737,000 acres of private industrial timber access across the state, with 240,000 acres more in contract discussions. WDFW's goal is to continue preserve its current access agreements and to pursue new opportunities for the public regarding access to private industrialized timberland. In Fall, 2022, a team of Private Lands Biologists presented a proposal to WDFW leadership that laid out a plan and funding request to increase access to timber properties in the future. The proposal process is moving forward towards a formal request to the legislature.

In 2020, efforts began to 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 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 requesting to access their lands for fishing or other forms of recreation. Fishing and wildlife viewing access are two primary components of the 2020 VPA-HIP grant. In addition, we are actively searching for landowners interested in these types of opportunities and continuing to expand on our current hunting opportunities.

Landlocked public acreage has become a highlighted issue across the nation in the past year. WDFW works with internal and external partners to identify landlocked public lands throughout the state. In many cases, these public lands are landlocked by private land. Local WDFW staff continue to assist in negotiating access to these landlocked areas across the state. Over the next few years, this will be a priority for staff. Interagency cooperation will be crucial as we determine the best ways to access landlocked public lands across the state.

In early 2021, the Private Lands Access Program acquired management of the ADA Road Access Entry Program, which was previously managed under a different group in the Wildlife Program. During the first year, the intent was to maintain the program under the status quo. However, as the Private Lands section manager implemented the program, it was determined that there would be many necessary changes in the upcoming years. One of the biggest concerns was the lack of outreach and communication to the ADA community regarding this program. There were also concerns about incorporating the necessary technological updates while providing the required assistance to those wanting to participate. In 2022, the permitting and drawing process was facilitated by the WDFW licensing and the WILD system. Roughly 300 hunters submitted their applications, and WDFW and their partners granted about 200 hunting permits. Continued improvement in communication is planned for next year in the form of email announcements, website banners, and mailers to encourage hunter involvement and to give instructions on the sign-up process.

Regional Information and Trends

Program objectives and priorities vary by region. The priorities are dependent on available habitat, species emphasis, and hunter access needs.

Conservation Reserve Program (CRP)

The U.S. Department of Agriculture (USDA) Farm Service Agency (FSA) held a general Conservation Reserve Program (CRP) signup from January 31 to March 11, 2022. During the general sign up 1,402 contracts were enrolled into CRP for almost 185,532 acres statewide. As part of this signup, FSA moved State Acres for Wildlife Enhancement (SAFE) whole field practices (grasses and trees) back to Continuous CRP (CCRP) from the recent change to general CRP. During the sign up, producers enrolled over 35 contracts into the SAFE program for more than 4,800 acres. There are a large amount of CRP contracts expiring this year in Douglas County and other SAFE heavy counties, so we are expecting increasing SAFE signups there. WDFW's private lands biologists provided technical assistance to producers with new SAFE contracts as well as producers with prior SAFE contracts.

Region 1

Region 1 is one of the 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 1 also holds a significant amount of industrial timber land open to public access. Under the current 2020 VPA grant, the focus for this region is on big game and upland bird hunting opportunities, but new funding is also available to expand opportunities in waterfowl, turkey/dove, fishing, and wildlife viewing.

Region 2

Region 2 holds the second highest number of enrolled acreages in the state behind Region 1 and is one of the state's most popular areas for waterfowl and upland bird hunters. The Department is constantly exploring other opportunities to expand both waterfowl and upland hunting acreage in this region. Under the current 2020 VPA grant, the top three priority species for this region are big game, waterfowl, and upland bird hunting. There is also funding available for turkey/dove, and wildlife viewing in certain areas of the region.

Region 3

A large portion of the acres available in Region 3 are enlisted in 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 in Ellensburg. There are also additional large acreage properties available for waterfowl hunting in the Register to Hunt program. Under the current 2020 VPA grant, the top priority species in this region are waterfowl, upland bird hunting, and big game. There are limited funds available for some fishing and wildlife viewing enhancement throughout the region.

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 2016, the Department extended recreational opportunities by signing agreements with landowners for wildlife viewing, which will be continued under the current 2020 VPA grant. 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. Waterfowl hunting is the largest priority for this region. However, under the 2020 VPA grant there is also funding available to expand big game, fishing, and wildlife viewing opportunities.

Region 5

The program in Region 5 has primarily focused on Klickitat County where the majority of the acreage has 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. Being previously understaffed, the region now has a full-time private lands biologist, and we expect to see some expansion for the program in this region in the upcoming years. As in regions 4 and 6, there is a good portion of land that is owned by private industrial timber companies. Regional staff have been successful working with several local companies to negotiate no fee access for the general public, especially for big game hunting. In the past year, there have been some significant expansions to the industrial timber acreage available to the public in this region. Under the current 2020 VPA grant, opportunities are vast in this region. There are funds available to aid expansion in big game, waterfowl, upland bird hunting, turkey/dove, fishing, and wildlife viewing.

Region 6

As in Region's 4 and 5, opportunities in Region 6 are vast. The large focus for acreage includes waterfowl hunting and industrial timber hunting access. Region 6 also has a few private properties that are popular for pheasant hunting. As in Region 4, a great deal of effort in Region 6 was devoted to working with large industrial timber companies that may not be enrolled in formal contracts. The relationships built between the private land's 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. Under the current 2020 VPA grant, the top priority species for this region is waterfowl. However, there is also funding available for big game, fishing, and wildlife viewing opportunities.

The Department's Private Lands Access Program continues to be a valuable asset to the hunting public and the landowners who choose to participate. Urban development and changing land uses have continued to reduce the amount of land available to hunters. Implementing fee access 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 in communication efforts with those large landowners. Implementing the high-cost fee-based permit programs has limited the ability of some hunters to acquire access to huntable timberlands. Presently, the Department does not have the resources to match the income potential of these programs. In some instances, the Department has successfully encouraged landowners to increase the number of low-cost permits to allow additional hunters to access those properties. As a result, hunters unwilling or unable to obtain permits must look elsewhere for hunting access, which increases pressure on other private and public lands.

WDFW is determined to increase public access and hunter opportunities. The Department will continue to pursue funding sources and no cost agreements to improve recreational access for the public across the state of Washington.

Landowners or landholders interested in the Private Lands Program should visit WDFW's Private Lands Program webpage and contact your local Private Lands Biologist by referencing the work areas map. *Access to private land is a privilege, not a right.*

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Regional Totals		
Regions	**Acreage**	**Cooperators**
Region 1	309,487	297
Region 2	250,361	118
Region 3	77,977	36
Region 4	267,975	50
Region 5	76,052	17
Region 6	245,054	17

Timber acreage currently under contract, negotiation, or under non-formal agreements		
Cooperators	**Acreage**	**County**
4	146,000	Spokane
2	280,000	Skagit, Whatcom
2	71,000	Vancouver
3	240,000	Montesano

Feel Free to Fish		
Cooperators	**Acreage/Feet**	**County**
2	1,604/ac	Montesano
2	1,795/ft	Columbia
6	96,755/ft	Walla Walla

Wildlife Viewing		
Cooperators	**Acreage**	**County**
1 – Feel Free to View	142	Montesano
1 – Register to View	40	Yakima

	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	8	7,277	1	2,034	0	0	39	89,817	0	0	48	99,128
Asotin	1	1,477	0	0	2	4,218	8	8,129	0	0	11	13,824
Benton	0	0	3	1,882	0	0	3	16,194	1	86,907	7	104,983
Chelan	0	0	0	0	0	0	0	0	0	0	0	0
Clallam	0	0	0	0	0	0	0	0	0	0	0	0
Clark	0	0	0	0	0	0	0	0	0	0	0	0
Columbia	17	33,622	0	0	0	0	14	19,644	0	0	31	53,266
Cowlitz	4	621	0	0	0	0	0	0	0	0	4	621
Douglas	6	13,640	1	2,255	0	0	23	52,400	0	0	30	68,295
Ferry	0	0	0	0	0	0	8	2,052	0	0	8	2,052
Franklin	6	4,266	4	4,570	3	8,450	9	16,455	0	0	22	33,741
Garfield	8	8,512	1	4,970	1	1,837	13	24,817	0	0	23	40,136
Grant	6	10,126	4	33,721	0	0	30	66,562	1	37,540	41	147,949
Grays Harbor	2	1,849	0	0	1	143	0	0	0	0	3	1,992
Island	5	1,280	0	0	0	0	0	0	0	0	5	1,280
Jefferson	0	0	1	118	0	0	0	0	0	0	1	118
King	1	288	0	0	0	0	0	0	0	0	1	288
Kitsap	0	0	0	0	0	0	0	0	0	0	0	0
Kittitas	0	0	2	11,520	0	0	0	0	0	0	2	11,520
Klickitat	4	59,584	3	1,439	0	0	1	40	0	0	8	61,063
Lewis	1	200	0	0	0	0	0	0	0	0	1	200
Lincoln	5	4,909	0	0	0	0	28	37,249	0	0	33	42,158
Mason	3	688	2	533	0	0	0	0	0	0	5	1,221
Okanogan	0	0	0	0	0	0	0	0	0	0	0	0
Pacific	2	65,392	0	0	0	0	1	68	0	0	3	65,460
Pend Oreille	1	7,757	2	478	0	0	0	0	0	0	3	8,235
Pierce	0	0	0	0	0	0	0	0	0	0	0	0
San Juan	0	0	4	145	2	190	0	0	0	0	6	335
Skagit	5	420	3	345	9	1,094	2	260,918	0	0	19	262,777
Skamania	0	0	1	1,204	0	0	0	0	0	0	1	1,204
Snohomish	0	0	2	119	3	249	0	0	0	0	5	368
Spokane	2	128,610	2	2,191	0	0	5	6,416	1	2,878	10	140,095
Stevens	1	16,937	2	1,349	0	0	14	9,927	0	0	17	28,213
Thurston	0	0	0	0	0	0	0	0	0	0	0	0
Wahkiakum	1	12,199	0	0	2	259	0	0	0	0	3	12,458
Walla Walla	38	66,142	2	7,480	0	0	24	26,802	0	0	64	100,424
Whatcom	0	0	3	788	9	2,139	0	0	0	0	12	2,927
Whitman	8	5,812	41	60,468	0	0	32	33,295	0	0	81	99,575
Yakima	3	5,420	0	0	1	3,100	5	12,066	1	8,727	10	29,313
Totals	138	457,028	84	137,609	33	21,679	259	682,851	4	136,052	518	1,435,219

** Some landowners have acreage that spans multiple counties. For these situations, landowners are represented in one county that they own property. LHP is the one exception since there are only 4 landowners. These are represented in a single county.*

Human-Wildlife Interaction

Human-Wildlife Interaction Status and Trend Report

STATEWIDE

JIM BROWN, Wildlife Conflict Section Manager

Introduction

The Washington Department of Fish and Wildlife (WDFW) renewed its focus on human-wildlife conflict management in recent years. This report is intended to illustrate efforts to meet the Game Management Plan objectives while creating a historical account of human-wildlife conflict management actions. In addition, WDFW has implemented programs to provide opportunities for improved knowledge in developing specific strategies and tools for mitigating negative human-wildlife interactions in Washington for the 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 the social tolerance of wildlife populations using the otherwise available habitat. Through the application of integrated wildlife management techniques designed to prevent or mitigate negative human-wildlife interactions, WDFW can improve the social tolerance of wild animals. By doing so, wildlife managers can increase wildlife populations by increasing the use of existing habitats on heavily human-influenced landscapes.

The convergence of human population expansion, nature-based tourism, and escalating interest in outdoor recreation will likely increase the frequency of negative or unwanted human-wildlife interactions. Maintaining a healthy ecosystem for humans and wildlife will require innovative approaches to minimize these conflicts. These approaches must include science-based decision making that incorporates public opinion for social context. WDFW is committed to informing and assisting the public to employ proactive measures and to provide a quick and effective response once unwanted interactions and property damage occur (Conover, 2001).

WDFW conducted an opinion survey that identified 29% of the Washington public as having 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 has not always conducted formal assessments of negative human-wildlife interaction complaints. Current trends indicate that human-wildlife conflict resolution in Washington is necessary, 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 ten 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 the prevention, mitigation, and when, necessary, compensation for property damage or loss (as provided by law). An effective strategy for managing negative human-wildlife interactions is to allow employees a degree of flexibility to test and implement 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.

In addition to accounting for negative human-wildlife interaction issues when setting recreational harvest seasons and limits, WDFW deploys other tools when traditional recreational harvest cannot resolve the issue. WDFW has used hunters to assist with deer, elk, and turkey damage issues and hound handlers, trappers, and hunters to assist with bear and cougar depredation events. In each case, criteria must be met, and restrictions direct the final disposition of the animal harvested.

WDFW continues to use a three-category system to respond to human-wildlife interaction issues: 1) public safety response, 2) non-public safety requiring assistance, and 3) self-help. Self-help involves referring a customer to the WDFW web site to obtain an answer to a wildlife-related damage 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 primarily for public safety interactions involving bear, cougar, moose, and wolves. Non-public safety wildlife interactions, including depredations involving deer, elk, turkey, black bear timber damage, and 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 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 for the removal of one or more offending animals through the use of licensed hunters or agency kill authority. During the 2021 damage season (April 2020–March 2021), a total of 2,049 permits were issued to remove offending deer, elk, and turkey (Table 1).

Table 1. Total damage prevention and kill permits issued by Washington Department of Fish and Wildlife by region for deer, elk, and turkey, April 2020–March 2021.

Permit	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Total
DPP Deer	216	28	82	18	-	37	**381**
KP Deer	119	26	31	30	3	37	**246**
DPP Elk	107	-	433	13	77	128	**758**
KP Elk	188	27	33	54	56	109	**467**
DPP Turkey	11	-	-	-	8	-	**19**
KP Turkey	170	8	-	-	-	-	**178**
Total	**811**	**89**	**579**	**115**	**144**	**311**	**2,049**

Table 2. Total reported successful harvest by hunters with deer and elk damage tags for each Washington Department of Fish and Wildlife by region, April 2020–March 2021.

Damage Tag Type	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Total
Deer	89	6	22	-	-	8	**125**
Elk	22	-	101	3	20	36	**182**
Total	**111**	**6**	**123**	**3**	**20**	**44**	**307**

Licensed hunters with a DPP must purchase a damage tag to participate in a deer or elk damage resolution hunt and can retain the deer or elk. Hunters purchased 300 deer damage tags and 534 elk damage tags during the 2021 damage season; of those damage tag holders who reported (446 tag holders reported), 307 deer and elk were harvested for an estimated success rate of 69% statewide (Table 2).

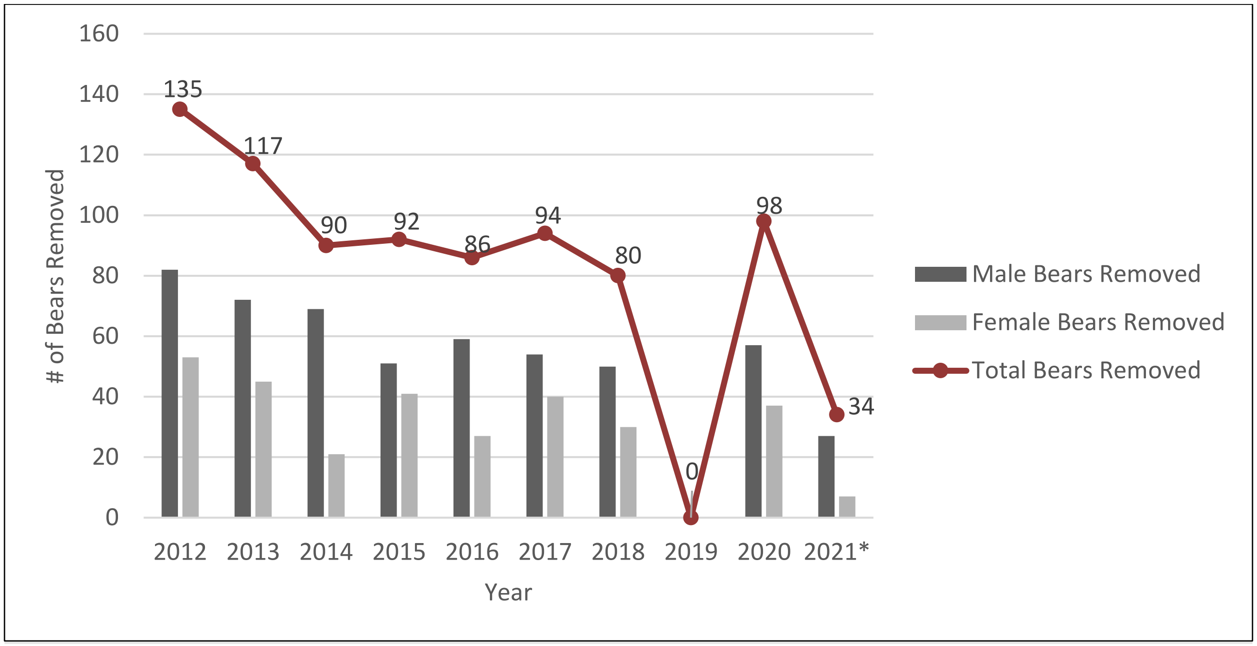
Black Bear Timber Damage

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 tree's growth or kill it, causing the potential for 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.

The original Bear Timber Damage Program was discontinued because the validity of a Washington Administrative Code (WAC 220-440-210) providing for the issuance and use of the black bear timber damage depredation permits was challenged in an appeal to the Washington State Court of Appeals. The court invalidated the rule, and thus the Department has limited ability within the current laws period.

Commercial forest landowners and managers experiencing timber damage caused by black bears may request a kill permit for the timber-damaging black bear. This permit request is initiated by working with the local Wildlife Conflict Specialist, who will evaluate the current damage, discuss the use of any non-lethal measures to address the situation, and ultimately decide if a kill permit is an appropriate option. The number of kill permits issued in response to black bear timber damage (23 permits) and the number of bears harvested for the 2021 damage period (two black bears) was significantly lower than the depredation permits issued and bears harvested in previous years under the original program. The following information is provided to illustrate historical trends.

Table 3. Number of male and female black bears removed annually during the bear timber damage period, 2012–2021.



Starting in 2021 USDA-APHIS Wildlife Services data is included in the total number of bears removed.

A total of two male bears were removed during the 2021 timber damage period.

Commercial forest landowners and managers can work with the Wildlife Services section of the United States Department of Agriculture's Animal and Plant Health Inspection Service (USDA-APHIS Wildlife Services) in mitigating black bear timber damage. During the 2021 timber damage period, USDA-APHIS Wildlife Services removed 32 bears (7 females, 25 males).

The 2021 black bear harvest total, including the recreational harvest, the spring permit hunt, and bear timber damage removals (including USDA-APHIS Wildlife Services), was 1,720 bears statewide. Black bear timber damage removals represented 2% of the statewide harvest.

Carnivore (black bear, cougar, and wolf) depredation on livestock

Accounts of managing and responding 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 the fiscal year 2021.

Cost-share and Prevention measures for livestock losses

WDFW offers cost-sharing with livestock producers for deploying conflict prevention measures to minimize livestock loss to wolves. Producers who 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 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, bio fencing), and protecting livestock rearing areas. The most common measures deployed by producers under DPCA-L's 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 2021 (July 1, 2020 – June 30, 2021), there were 31 DPCA-L's written with livestock producers statewide.

In addition to DPCA-Ls, WDFW also contracted range riders to assist ranchers in minimizing livestock losses caused by wolves. Range riders are skilled at herd management and monitor for potential wolf presence within the vicinity of livestock while providing 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; and frequent communication with the livestock producer and WDFW staff regarding planned livestock movements and grazing plans. During the fiscal year 2021, WDFW had 11 range rider contracts that utilized up to 17 riders throughout the year.

Wildlife Damage Claims

Agriculture

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 2022 (July 1, 2021 – June 30, 2022) was $178,005.00.

Livestock

Commercial livestock producers who experience livestock loss caused by bear, cougar, or wolf may be eligible for compensation under WAC 220-440-170 and WAC 220-440-180. 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 for direct livestock losses (i.e., losses determined by WDFW to be confirmed or probable) caused by wolves in fiscal year 2022 was $8,116.50. The total compensation for direct livestock losses caused by cougars in fiscal year 2022 was $6,530.50.

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, including 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. The total compensation paid for indirect livestock losses caused by wolves in fiscal year 2022 was $26,163.92.

Wildlife Control Operators

Wildlife Control Operators (WCO) are private individuals certified by WDFW to assist landowners in preventing or controlling wildlife-related damage for a fee. A WCO is allowed to harass, control, and 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 goat, turkey, or protected or endangered wildlife.

The statewide Wildlife Conflict Management and Prevention Section at the WDFW office in Olympia administers the WCO program. Classes for WCO certification were originally held four times per year, alternating between the Olympia and Spokane WDFW offices. As of August 2020, the training transitioned to a virtual platform in response to COVID-19. With increased capacity for statewide attendance, the virtual trainings have been hosted twice in the last year. Once a person meets all the requirements for becoming a WCO (WAC 220-440-100), completes the WCO training, and passes the qualifying exam, they are presented with a certificate valid for three years that allows the individual to handle specific nuisance wildlife issues year-round and statewide. Thirty-one (31) people completed training and were certified as WCOs in 2021, compared to 21 people in 2020. Currently, there are 226 people in Washington State with valid WCO certificates.

Special Trapping Permit

Property owners experiencing wildlife-related damage to their property are allowed to mitigate the problem by capturing and 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), valid for 30 days, authorizing 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 2021, 432 STPs (including renewals) were issued statewide, which allowed for the removal of certain wildlife causing damage to public or private property. The 2021 value is a decrease from the 531 permits issued in 2020. The most common authorization requested was for trapping mountain beaver within industrial timberlands.

In 2021, requests for STPs and corresponding wildlife removals were variable by month, but the highest numbers generally occurred fall through spring. In the last year, we saw a peak in permits issued in July. 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 2021.

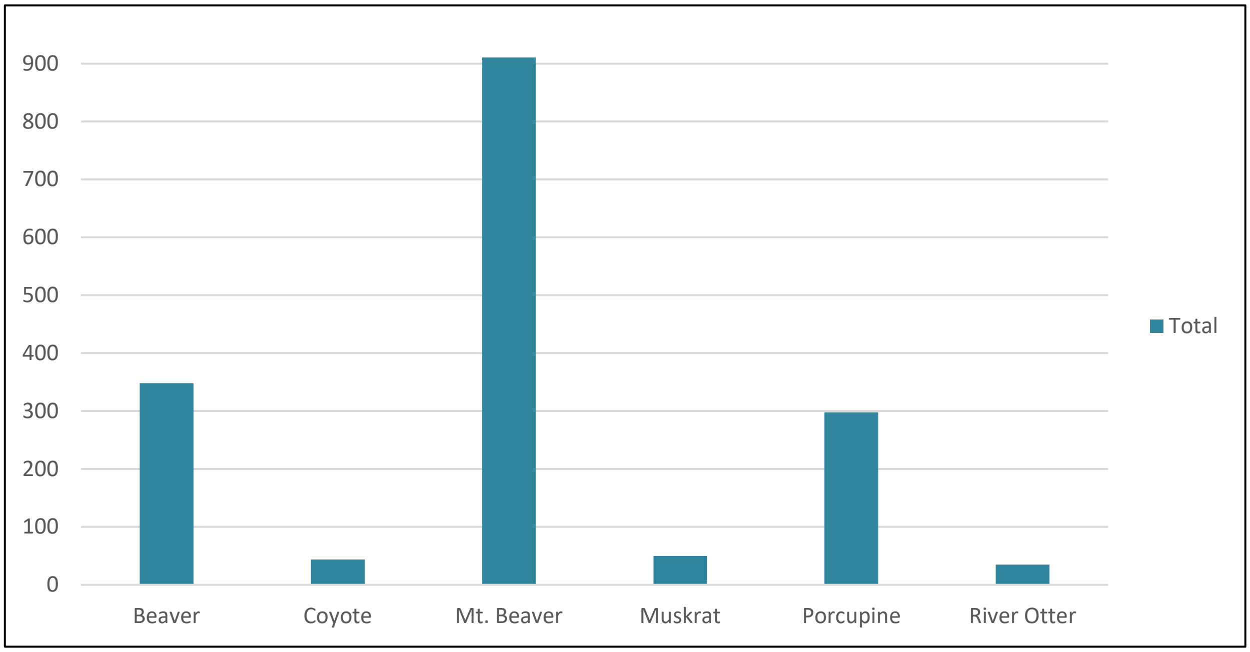
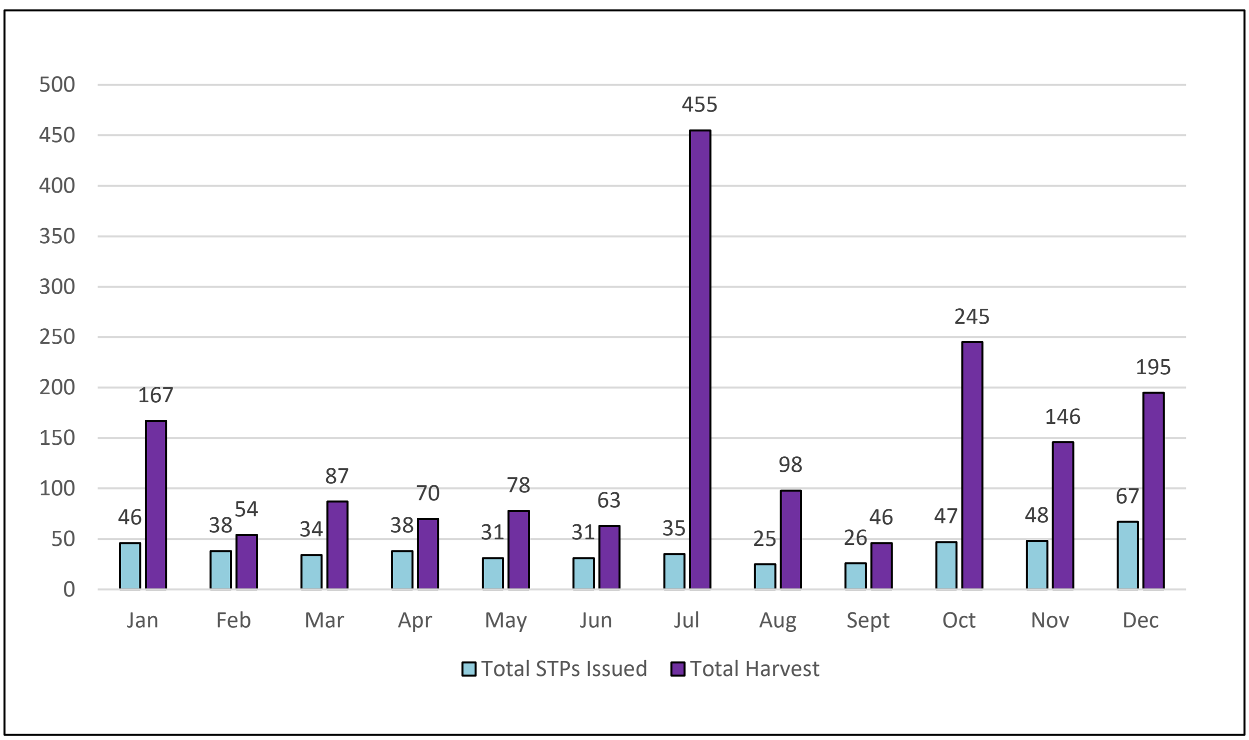


Table 5. Total number of wild animals reported trapped with Special Trapping Permits (STP) and the total STPs issued each month, 2021. The number of wildlife reported trapped in each month is based on reporting for 30-day permits that ended within a given month.



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 for wildlife living in habitat that might otherwise be unavailable to many species, including big game. Managing and preventing wildlife conflict requires using various 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 can lead to potential conflict.

During 2020, 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 section is committed to continuous improvement in managing negative human-wildlife interactions using a combination of the best science and the 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, 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 upcoming years are to improve outreach and information sharing through multimedia approaches (e.g., print, audio, visual, and social media platforms).

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