DRAFT

Idaho

Idaho Gray Wolf Management Plan

2023-2028

Prepared by **IDAHO DEPARTMENT OF FISH AND GAME**

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Executive Summary

The Idaho Department of Fish and Game is committed to managing wolves for a stable, self-sustaining population in suitable habitat for conservation purposes and harvest opportunity, and our management objectives must also address the challenges of chronic livestock depredations and persistent impacts on ungulate populations.

These challenges remain, even after a decade of increasingly permissive hunting and trapping and focused agency control actions. Idaho's wolf population has remained robust and has proven resilient to human-caused mortality. Wolf management therefore involves navigating diverse social opinions, complex predator-prey interactions, biological factors, and economic impacts.

This Idaho Gray Wolf Management Plan incorporates knowledge gained from nearly 3 decades of wolf monitoring and management about how wolves use Idaho's landscape, interact with native ungulates and livestock, and react to different levels and types of harvest. The Plan identifies goals and strategies to reduce wolf numbers and to manage Idaho's wolf population to fluctuate around 500 animals. The Plan also describes mechanisms for moderating wolf mortality as the population approaches 500, improving monitoring techniques, and managing for wolf conflicts with both livestock and ungulates.

An objective fluctuating around 500 animals aligns with state wolf management envisioned in the federal rule (2009) delisting wolves under the Endangered Species Act. With improved population estimation, it is clear that Idaho's population has been well above this objective since delisting. During 2019-2021, Idaho's wolf population has fluctuated around 1,270 animals during the annual cycle of reproduction and mortality (harvest, depredation control, and other human-caused mortality = ~33%, see Mortality section). Idaho's current population level is above what the US Fish and Wildlife Service considered to be the management objective based on carrying capacity for the entire Northern Rocky Mountain population in Idaho, Montana, Wyoming, Oregon, and Washington.

The current wolf population in Idaho continues to cause chronic conflicts with livestock and other domestic animals in many parts of the state. These detrimental impacts are consistent with what the 2009 delisting rule predicted would occur as the Northern Rocky Mountain wolf population grew to exceed carrying capacity. Since 2014, at least 299 livestock producers have experienced more than 1,291 verified losses to wolves, and we know these verified losses represent only the minimum of total wolf depredations.

Wolf impacts on Idaho's ungulate populations are complex. Elk are the primary prey of wolves in Idaho, and IDFG has identified wolf predation as a primary factor preventing recovery of several elk zones that are below objective. In these areas, IDFG has implemented predation management plans, which in some zones include supplemental wolf removal to relieve predation impacts to help elk populations rebound.

Driven by our knowledge of the effects of wolf harvest and effects of wolves on livestock and ungulates, IDFG has worked to improve its wolf monitoring program. The initial strategy of radio-collaring and monitoring dozens of packs across the state annually proved insufficient and cost-prohibitive as Idaho's wolf population grew. IDFG's monitoring goal is to provide repeatable, robust, and cost-effective estimates of abundance, distribution, and reproduction monitoring.

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Introduction

Idaho's gray wolf (*Canis lupus*) population remains abundant and resilient after over a decade of regulated hunting and trapping and deliberate response to livestock depredations. The Idaho Department of Fish and Game (IDFG) is committed to maintaining and managing a viable, self-sustaining wolf population and understands that wolves bring social, economic and biological challenges.

The Idaho Fish and Game Commission (Commission), through its oversight of IDFG, is the primary steward of wildlife resources for the citizens of Idaho. The Commission and IDFG have a legal responsibility to preserve, protect, perpetuate, and manage all of Idaho's wildlife (Idaho Code 36-103). The Commission classifies gray wolves as a big game animal. Building on IDFG's Strategic Plan, this 2023-2028 Wolf Management Plan provides guidance to IDFG staff for monitoring and managing wolf populations, conflicts, and harvest, for the next 6 years. This Plan incorporates direction from the 2002 Idaho Wolf Conservation and Management Plan (2002 Wolf Plan) prepared to support delisting of wolves under the Endangered Species Act (ESA) and post-delisting management.

The introduction and management of gray wolves has been one of the most prominent wildlife management activities of the past 50 years. Wolf recovery was achieved in Idaho in 2003, when federal delisting requirements were met, but social, political, and legal controversy still surrounds the management of gray wolves in the state. Wolf management is complex and affected by the public's diverse attitudes towards predators. Hunting and trapping play an important role in promoting public advocacy and tolerance for wolves by regulating populations and managing conflicts.

In 2011 the Commission adopted a framework for wolf management which directed IDFG to:

1. Manage wolves in a manner that will ensure wolves remain under responsible state management in conjunction with the rest of Idaho's wildlife.
2. Manage wolves as big game animals consistent with the goals and objectives of the 2002 Idaho Wolf Conservation and Management Plan approved by the Idaho Legislature and U.S. Fish and Wildlife Service (USFWS) to keep wolves off the Endangered Species List.
3. Control wolves where they depredate on livestock and other domestic animals or threaten human safety.
4. Control the population of wolves and other predators as needed to address areas where elk or other prey populations are below management objectives.
5. Develop wolf hunting and trapping season recommendations for Commission consideration.
6. Conduct additional species management planning as appropriate.

This framework remains relevant and is incorporated in this plan.

Consistent with the USFWS's 2009 delisting decision, IDFG is committed to maintaining a viable, self-sustaining wolf population well-distributed in suitable habitat. IDFG is also committed to managing the population at a level that minimizes conflicts with both livestock and ungulate populations, while remaining connected with wolf populations in Montana, Wyoming, Oregon, Washington, and Canada.

Plan Development Process

A diverse team of biologists, researchers, enforcement and communications staff from across the state supported plan development. Elk, Mule deer, White-tailed deer, and Moose Management Plans, as well as Predation Management Plans for the Panhandle, Lolo/Selway, Middle Fork, and Sawtooth Elk Zones help guide the management direction of this plan. IDFG published a draft plan for public input with associated outreach.

Background and Current Status

ESA Listing and Recovery

Soon after the federal Endangered Species Act (ESA) was passed in 1973, the USFWS listed four subspecies of gray wolves as endangered, including a Northern Rocky Mountain (NRM) subspecies. In 1978 USFWS found this taxonomy out of date and relisted the gray wolf as endangered at the species level throughout the conterminous 48 states, except for Minnesota where it was reclassified as threatened.

The USFWS Northern Rocky Mountain Gray Wolf Recovery Plan, developed in 1980 and updated in 1987, established wolf population recovery criteria of 10 breeding pairs in each of three areas (central Idaho, northwest Montana, and Greater Yellowstone). The recovery plan called for continued natural colonization of wolves into northwest Montana and central Idaho from the western Canada population. The plan also called for translocation of wolves into the Yellowstone Ecosystem (USFWS 1987).

After additional analysis and lawsuits, USFWS proceeded to introduce wolves into both Yellowstone National Park and the Frank Church River of No Return Wilderness in central Idaho. During 1995 and 1996, 66 wolves were captured in Alberta and British Columbia, and released in Yellowstone National Park (N = 31) and central Idaho (N = 35), approximately doubling the known NRM wolf population. From 1995 to 2008, the NRM wolf population increased an average of about 22% annually, with increases ranging from 8% to 50% (USFWS 2009). Subsequently, wolves extended their occupation in Idaho well beyond the boundaries of designated wilderness and have occupied considerable expanses of unsuitable habitat. Wolf populations in all 3 recovery areas (NW Montana, central Idaho, and Greater Yellowstone) achieved recovery standards (at least 10 breeding pairs and 100 wolves in each area for 3 successive years) by December 2002.

The Idaho Legislature adopted House Joint Memorial No. 5 in 2001, requesting the federal government remove wolves from Idaho, which did not occur. In 2002, the Idaho Legislature approved a revised version of the *Idaho Wolf Conservation and Management Plan*, developed by a Delisting Advisory Team in accordance with Idaho Code 36-2405 (Idaho Legislative Wolf Oversight Committee 2002). The 2002 Plan described the state's planned management of wolves in Idaho to support federal delisting.

Delisting

USFWS first delisted the Northern Rocky Mountains Distinct Population Segment (DPS) of gray wolves in February 2008 (USFWS 2008). The 2008 delisting rule required each state to manage for 15 breeding pairs and 150 wolves in mid-winter. ESA protections were reinstated in July 2008, after a U.S. District Court identified deficiencies in Wyoming regulatory mechanisms. The USFWS delisted wolves in the NRM DPS outside of Wyoming for a second time in May 2009 (USFWS 2009). Idaho's first wolf hunting season occurred during fall 2009. ESA protections were reinstated by a U.S. District Court ruling in August 2010. On May 5, 2011, wolves in the Northern Rocky Mountains were again delisted after congressional action required USFWS to re-adopt the 2009 delisting rule. The standard federal monitoring oversight under the ESA ended 5 years later, on May 5, 2016, putting wolf management entirely within state purview.

In addition to requiring a minimum of 15 breeding pairs and 150 wolves in mid-winter, the 2009 delisting rule also states that after delisting, wolves *"will be managed by the states, National Park Service, and Service to average over 1,100 wolves, fluctuating around 400 wolves in Montana, 500 in Idaho, and 200 to 300 in Wyoming,"* and that the carrying capacity of the Northern Rocky Mountains wolf population is likely around 1,500 wolves (USFWS 2009). It further states that *"attempts to maintain the population above 1,500 wolves may be difficult because suitable habitat will be fully occupied and packs attempting to colonize unsuitable habitat would cause chronic conflict with livestock."* USFWS (2009) went on to assert their belief that *"maintaining the NRM gray wolf population at or above 1,500 wolves in currently occupied areas would slowly reduce wild prey abundance in suitable wolf habitat. This would result in a gradual decline in the number of wolves that could be supported in suitable habitat. Higher rates of livestock depredation in these and surrounding areas would follow. This too would reduce the wolf population because problem wolves are typically controlled."*

Consistent with the 2009 delisting rule's prediction, detrimental impacts in the form of chronic livestock conflicts and negative impacts on ungulate populations occurred as the NRM population grew to exceed 1,500 wolves before delisting ultimately took effect. After congressionally directed delisting in 2011, the Commission authorized both hunting and trapping seasons. Idaho has continued to expand wolf hunting and trapping opportunities over time because Idaho's population has remained above or nearing carrying capacity, and detrimental impacts have persisted.

Wolf Ecology

Distribution

The gray wolf originally had one of the most extensive distributional ranges of any recent mammal (Nowak 1983). Unregulated killing and federally sanctioned predator eradication programs effectively eliminated the gray wolf from most of the western US between about 1880 and 1935. Wolf populations persisted in substantial numbers only in Alaska and Canada by the 1960s (Boitani 2003).

Wolves were historically distributed throughout most of Idaho (Goldman 1937) and persisted into the early to mid-1800s. By the 1940s, wolves were absent or very rare in Idaho and any present were likely migrants from Canada and Montana (USFWS 1987).

As the consequence of natural dispersal from Canada and Montana, and translocations of wolves into central Idaho and Yellowstone National Park, wolves in Idaho are now part of a contiguous population that extends across Canada from the Atlantic Ocean to the Pacific and from the Arctic to southern Wyoming, northern Colorado, southern Idaho, and currently northern California.

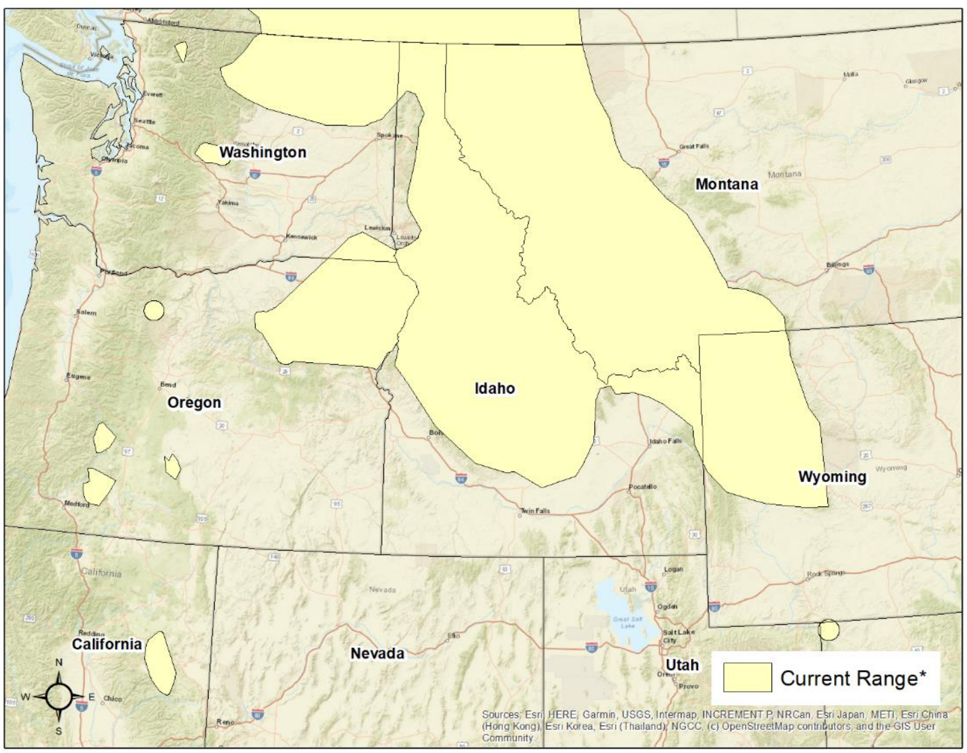

Figure 1. Current range of the gray wolf across western United States (*state data and the USFWS 2009).

In Idaho specifically, wolves are widely distributed throughout the state from the Canadian border in the north to the Snake River plain in the south (Figure 1). Wolves have expanded their range in Idaho outside of habitats deemed optimal for the species and are now being encountered more frequently in unsuitable habitats such as private lands where livestock conflicts may occur more frequently (Oakleaf et al. 2003, Oakleaf et al. 2006). Wolves are occasionally observed south of the Snake River in southern Idaho.

Wolves in central Idaho may be at carrying capacity; pack territoriality and density limit space for additional breeding pairs to establish new territories within high quality habitats. Approximately 28,000 mi^2 of Idaho (about 33%) is classified as "high quality" wolf habitat (Oakleaf et al. 2006). There is strong evidence that wolves are less abundant in areas with higher human activity that either increases wolf vulnerability to being killed or diminishes suitability of the habitat to support prey (Oakleaf et al. 2006, Ausband et al. 2010, Nelson et al. 2012).

Connectivity: Movement/Dispersal

Genetic research and collaring efforts have documented that movements and dispersals occur across the three NRM recovery areas and adjacent western states (vonHoldt et al. 2010, Jimenez et al. 2017, Hendricks et al. 2019). Wolves are known to disperse over long distances and across both suitable and unsuitable habitats. Most wolves in a natal pack will disperse away from that pack upon maturity (Mech and Boitani 2003). Triggers that potentially lead to dispersal include intense social and resource competition. An assessment of connectivity (Oakleaf et al. 2006) identified large intact corridors of quality suitable habitats that would aid in dispersal and genetic exchange between the northwestern Montana and central Idaho recovery areas.

Genetic variation was high among the founding wolves of the central Idaho and Yellowstone wolf populations (Forbes and Boyd 1997, vonHoldt et al. 2008, vonHoldt et al. 2010). Dispersal events lead to genetic exchange when breeding of individuals from different packs and regions occurs. Due to high dispersal rates and the long distances over which dispersal occurs, wolf populations are typically not isolated long enough to inhibit genetic diversity (Mech and Boitani 2003, Bassing et al. 2020). Further, results from genetic analyses indicate that wolf populations across northwest Montana, central Idaho, and the Greater Yellowstone Area are interconnected by wolf movements at a rate that prevents detrimental effects of long-term genetic isolation (Paetkau 2022). In addition, central Idaho wolves have high estimates of individual genetic variability 25 years after reintroduction; wolves that have naturally recolonized northern Idaho show a lower, but still high individual genetic variability (Ausband and Waits 2020). Field investigations of wolf dispersal and migration are consistent with genetic results (Boyd and Pletscher 1999). In summary, there is no evidence of inbreeding depression in NRM wolves.

Pack Structure and Reproduction

The pack is the basic social unit in wolf populations. Packs are formed when 2 wolves of opposite sex develop a pair bond, breed, and produce pups. Wolves typically do not breed until 22 months of age (Mech 1970). Breeding usually occurs only between the dominant male and female in the pack, but occasionally, a male may breed more than one female and a pack may produce more than one litter (Ballard et al. 1987, Smith 1998). For example, 10 wolf packs in Yellowstone produced 13 litters in 1997 (Smith 1998). In one of those packs, 3 females produced litters (Smith 1998).

Human hunting of wolves may affect pack size over time. In three Idaho study areas, Ausband et al. (2017) found that average pack size declined from 9.2 adults pre-harvest (2008) to 5.2 after several years of human harvest (2015). IDFG made similar findings in 2015: the post-harvest mean pack size was 6.4 wolves per pack (n = 41), lower than the pre-harvest average of 8.1 wolves per pack (2005 – 2008) (IDFG 2015). However, Ausband et al. (2017) determined harvest was not associated with an increase in frequency of breeder turnover or number of breeders per pack. This suggests that even in unharvested wolf populations breeder turnover is common.

In the NRM, wolves breed between late January and early March. Selection of denning sites is not well understood but is likely related to pack fidelity to a denning site (Fuller 1989), territorial boundaries with neighboring packs (Ballard and Dau 1983, Fuller 1989, Ciucci & Mech 1992), soil type and structure availability, and proximity to water (Mech 1970). Typically, 2 to 9 pups are born between late March and late April after a 63-day gestation period. In 2015, IDFG documented a mean litter size of 4.6 pups (*n* = 35) (IDFG 2015). Ausband et al. (2015) estimated average annual survival of wolf pups at 60% in years without harvest in Idaho (2008 and 2010), and 38% in years with harvest. Smith et al. (2010) estimated average annual survival of adult wolves (yearlings + adults) at 79% in years prior to wolf harvest in Idaho (1995 – 2004). As the pups become older, the pack typically moves them from the den to rendezvous sites. Wolves in Idaho appear to prefer wet meadow habitats for rendezvous sites (Ausband et al. 2010).

Gray wolves rarely disperse before 10 months of age, and most commonly disperse between 1 – 2 years of age (Mech and Boitani 2003, Treves et al. 2009, Jimenez et al. 2017). Some individual wolves may stay with the pack longer or will not disperse at all. Most dispersals from natal packs occur fall through spring.

Mortality

Although a variety of factors contribute to the ability of a wolf population to persist, the presence of sufficient prey and the influence of human-caused mortality are typically considered the two primary factors influencing wolf population dynamics (Keith 1983; Fuller 1989; Fuller 1995, Mech and Boitani 2003). Prey availability does not appear to limit wolf persistence in Idaho.

Total documented human-caused mortality includes mortality due to harvest from hunting and trapping, kill permits and agency actions to protect livestock and domestic animals (USDA Wildlife Services), agency control action to benefit elk populations, and other sources (*e.g.*, roadkill, illegal kill, and incidental trapping; Figure 2). Total documented mortality in Idaho has averaged 33% over the last 5 years. Nearly all documented mortality is human caused; non-human caused mortality is modeled using survival data and genetic tools (Ausband et al. 2015).

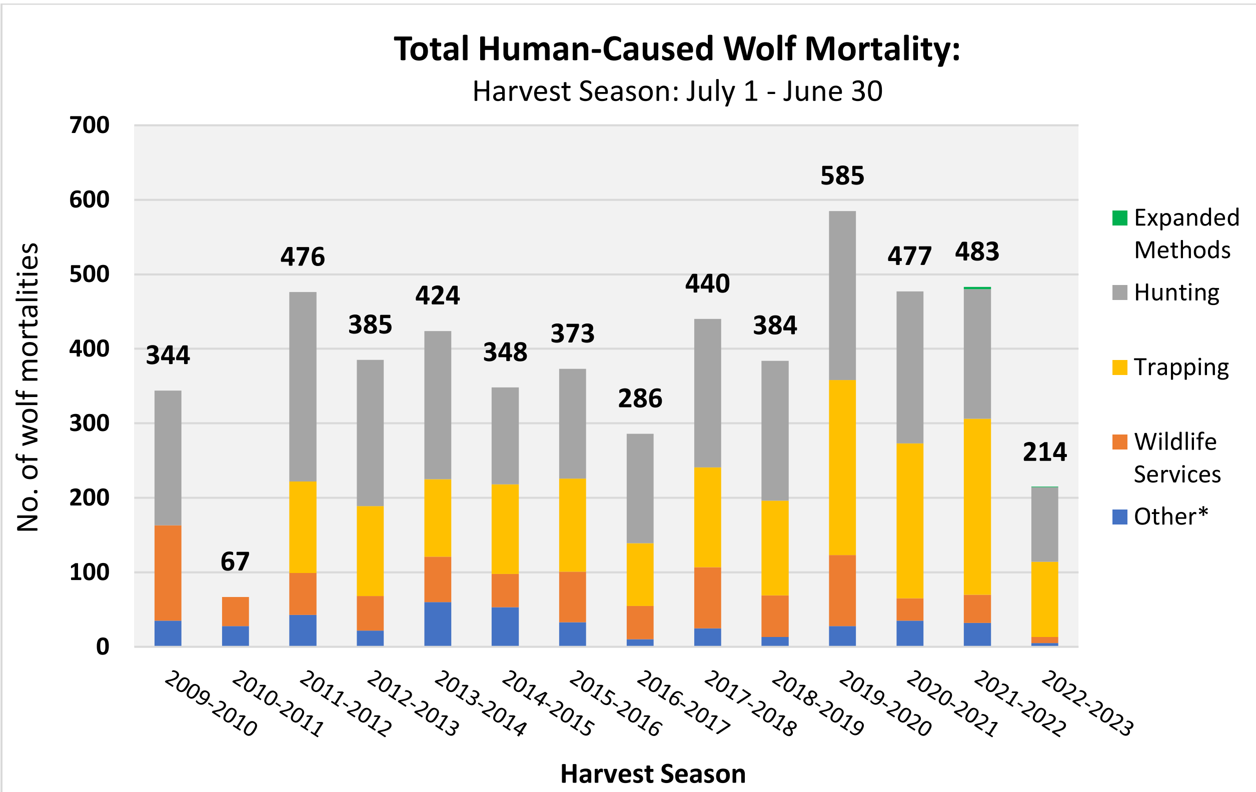

Figure 2. Idaho Human-caused Wolf Mortality by source, Harvest Seasons 2009/2010 – 2020/2021 (July 1 – June 30). Harvest Season 2022 – 2023 is still under way -- data current to 1/17/2023. *“Other” includes minimal mortality categories (*e.g.*, predation control, illegal take, depredation kill, roadkill).

In general studies have shown that human-caused mortality of less than 29% does not typically result in a sustained decrease in wolf populations because of the influences of compensatory mortality and/or immigration (Adams et al. 2008). Populations have been documented to remain stable or even increase in the face of human-caused mortality in excess of 45% (Ballard et al. 1987, Mech 2001, Gude at al. 2012).

Total human-caused mortality can be divided into harvest and non-harvest mortality. Most non-harvest mortality results from response to conflict (wolf-caused ungulate predation and livestock depredation). Since harvest seasons were implemented (2011 – 2021), non-harvest mortality has accounted for approximately one-quarter of the total annual documented human-caused wolf mortality.

Legal harvest through hunting and trapping is the primary source of wolf mortality in Idaho. Wolf populations appear resilient to the effects of low to intermediate levels of harvest (Hayes and Harestad 2000, Adams et al. 2008, Webb et al. 2011). Genetic data from wolves harvested in some of the state's more-heavily hunted units indicated harvest rates varied from 11.2% in 2016 – 2017 season to 27.6% in the 2012 – 2013 season (Ausband et al. 2015, Ausband and Waits 2020). This harvest rate varies across the state. In remote areas with limited access, such as in central Idaho, wolf densities will likely not be significantly altered by human harvest.

Feeding Habits

Wolves are effective predators and scavengers that feed primarily on large ungulates throughout their range (Murie 1944, Pimlott 1967, Mech 1970, Van Ballenberghe et al. 1975, Carbyn 1983, Ballard et al. 1987, Gasaway et al. 1992, Boyd et al. 1994). Ungulates comprise nearly all the winter diet of most wolves. Smaller animals become more important in the diet of wolves during the snow-free months, but ungulates remain the main food source. Small animals typically consumed by wolves include beavers, marmots, ground squirrels, snowshoe hares, pocket gophers, and voles. Porcupines, ruffed grouse, ravens, coyotes, striped skunks, and golden eagles have also been killed by wolves (Boyd et al. 1994). Although wolves feed primarily on large, wild ungulates, they also kill livestock and other domestic animals (Fritts and Mech 1981, Fritts and Paul 1989, Fritts et al. 1992, Bangs et al. 1995, 1998).

Wolves kill prey by running them down (coursing) rather than ambush. Prey selection and frequency of killing by wolves varies greatly depending on many factors including pack size, snow conditions, the diversity, density, and vulnerability of prey, and degree of consumption of the carcasses (Kunkel 1997). Areas without physical obstructions, such as open areas and less steep terrain, contribute importantly to the quality of wolf habitat (Mech & Boitani 2010). Climatic characteristics such as snow depth and snow density also influence the vulnerability of prey to wolves (Huggard 1993), and wolf habitat quality.

Health and Disease

Wolves in Idaho are known to be susceptible to a variety of diseases, including those caused by viruses (e.g., canine distemper, canine parvovirus, and canine infectious hepatitis), bacteria, and both internal (e.g., intestinal worms of various species, echinococcosis) and external (e.g., lice and ticks) parasites (Idaho unpublished data, http://idfg.idaho.gov/spp/5288). Wolves may develop individual and pack-level immunity to some common pathogens over time, some of which may be conferred to offspring through maternal antibodies (Gillespie and Timoney 1981). Although diseases can be significant sources of mortality for wolves, they have not been demonstrated to be population-limiting in Idaho.

Harvest Management

Harvest Background

Existing rules and laws provide IDFG the appropriate regulatory mechanisms to manage wolf populations through public harvest. Regulated harvest will likely provide the most effective tool for management of wolf populations.

Wolf hunting seasons were initiated in 2009 following delisting, temporarily halted when wolves were relisted in 2010, and reinstated upon delisting in 2011. Early wolf harvest seasons were closely managed using quotas and wolf management zones. Since then, hunting opportunities have been expanded almost every year by commission action (Figure 3). The structure of hunting and trapping seasons did not change in 2022.

Wolf trapping seasons were initiated in 2011, and similarly were initially limited to short seasons in just a few Game Management Units (GMUs). As we have gained understanding of resilience to harvest, trapping seasons have expanded to include longer seasons and more GMUs (Figure 4).

Most units in Idaho currently have a year-round hunting season on wolves and expanded hunting methods are allowed in Depredation or Predation Units (Figure 5) where wolves are causing unacceptable impacts to livestock or ungulates. Currently, trapping is open on private lands throughout the state (foothold trapping allowed year-round). Trapping seasons on public lands in most of the state run from November 15 to March 31. In areas outside of suitable habitat or where wolves are causing unacceptable impacts to livestock or ungulates, the Commission has authorized extended fall seasons for foothold trapping, with extended fall snaring seasons authorized in a few GMUs. Snaring seasons are restricted in some units to avoid incidental catches of grizzly bears.

Any individual that participates in wolf trapping must first attend a mandatory wolf trapper education course along with having a trapping license. Trappers are required to check their traps every 72 hours.

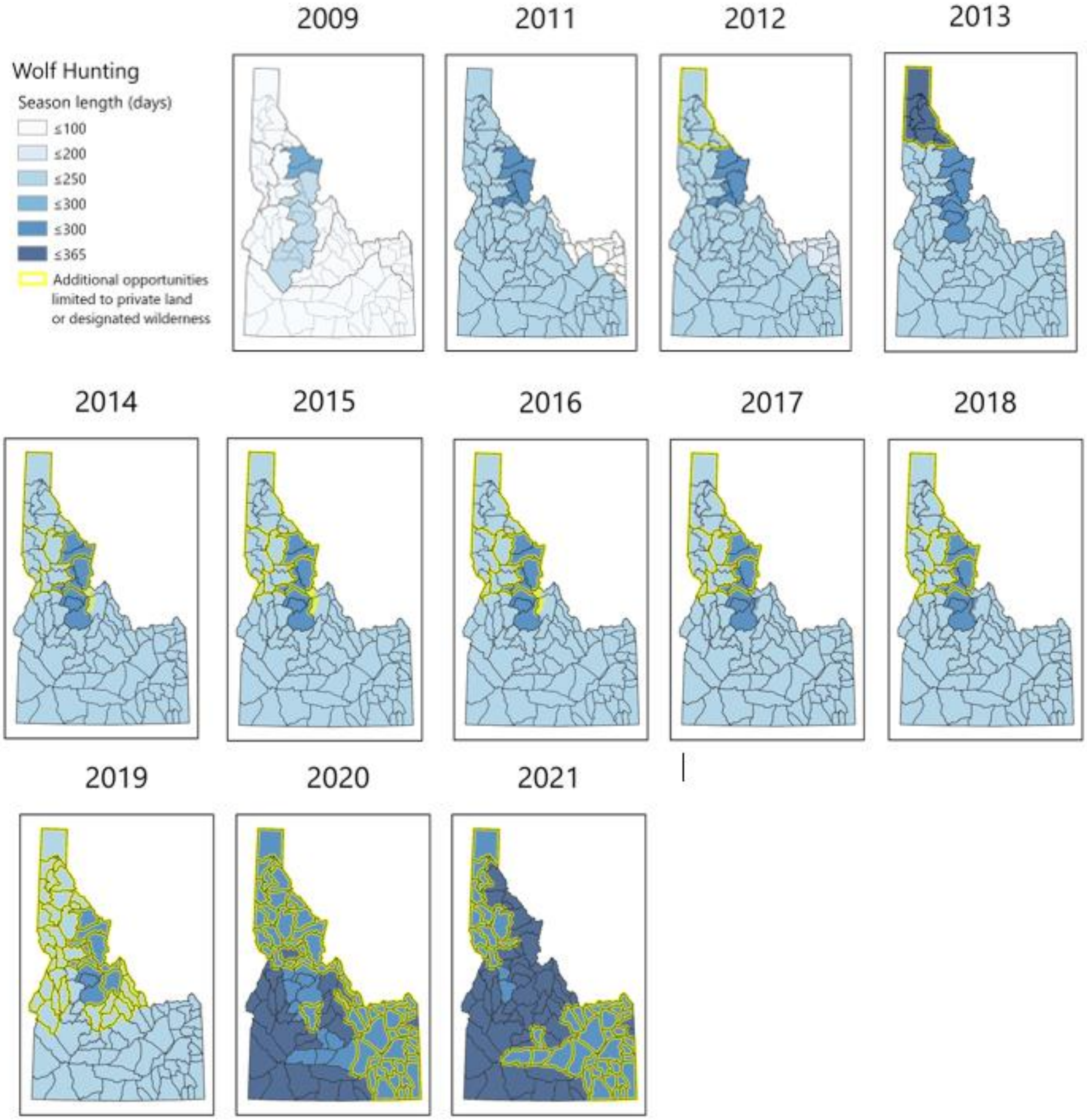

Figure 3. Progression of changes in wolf hunting seasons in Idaho, 2009 – 2021. The hunting season structure did not change in 2022.

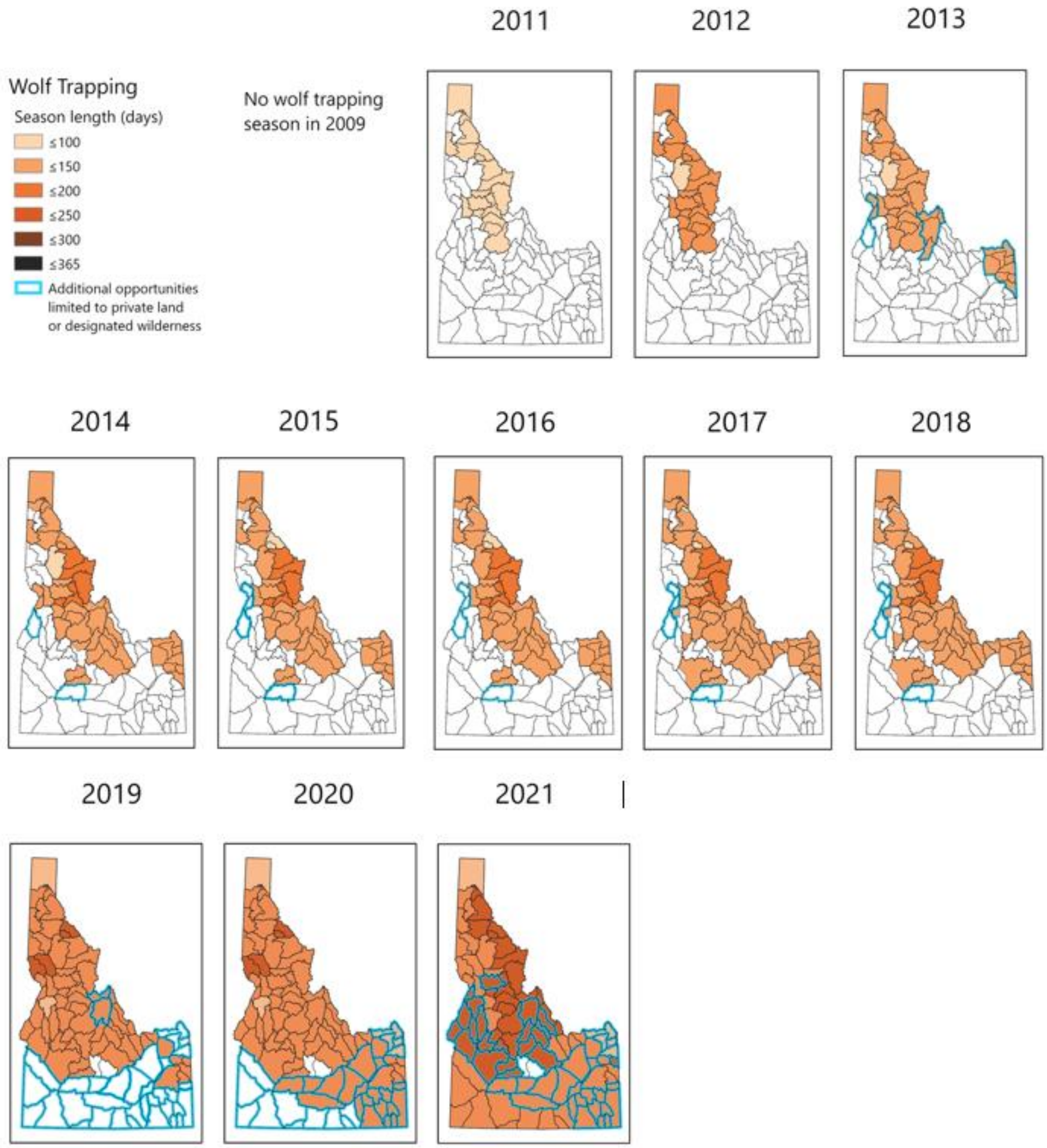

Figure 4. Progression of changes in wolf trapping seasons in Idaho, 2011 – 2021. The structure of the trapping season did not change in 2022.

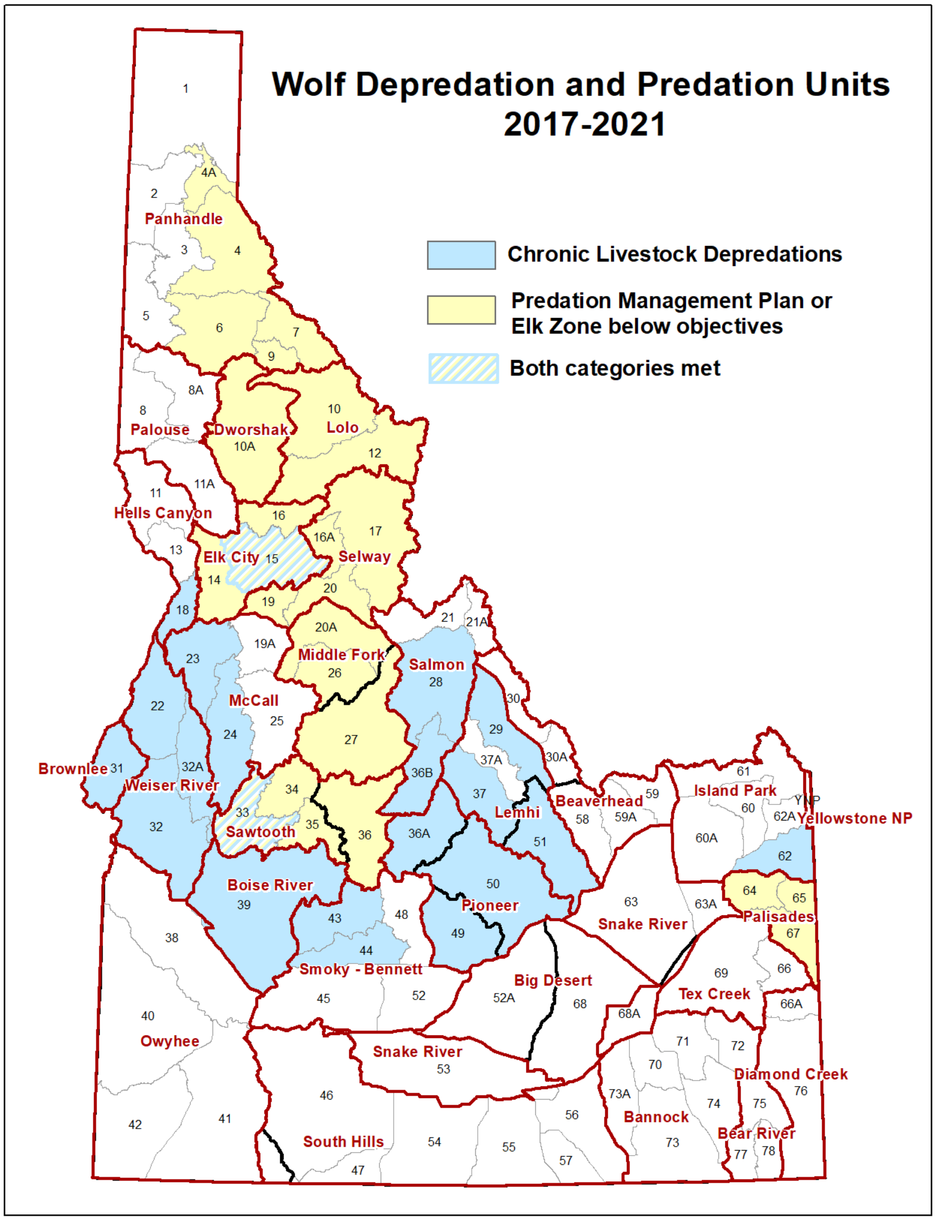

Figure 5. Game Management Units with chronic wolf-caused livestock depredations and underperforming elk populations from 2017 – 2021.

Wolf Tag Sales and Harvest

All wolves harvested and salvaged (roadkill) are required to undergo a mandatory check by IDFG staff within 10 days of take. Successful hunters and trappers are required to submit the skull and hide to IDFG staff for collection of biological data such as age, sex, method of take, harvest location, and DNA. Managers use this information to assess harvest demographics, harvest distribution and population dynamics to inform population management decisions.

Individuals may purchase an unlimited number of wolf tags. Tags must be purchased in advance of hunting or trapping, and a validated tag must be attached to each wolf immediately following harvest. To date, trapper and hunter participation indicates that allowing individuals to purchase an unlimited number of wolf tags has not, and likely will not, result in a significant change to number of tags purchased or number of wolves harvested. Despite the large number of wolf tags purchased, very few wolf hunters or trappers harvest more than 2 wolves annually. For Harvest Season 2021, 84% of sportsmen who harvested a wolf, harvested two or less. No one harvested more than 10 wolves; only one person harvested 10 wolves, one person harvested 9 wolves, one person took 8, and three people harvested 7. The most wolves any individual has taken in a single season is 20 (during 2019 – 2020 harvest season).

IDFG sold over 54,000 wolf tags in 2021, including 53,618 hunting tags. This number includes hunting tags purchased individually and those wolf hunting tags included in the Sportsman's Package. It is unknown how many of the individuals who purchased tags hunted for wolves as their target species (rather than carrying a wolf tag while primarily targeting other species). Between 2018 and 2022, the average number of wolf hunting tags purchased per sportsmen was 1.1 tags and the average number of trapping tags purchased per trapper was 2.1 tags. The highest number of hunting tags an individual purchased was 16 and the highest number of trapping tags purchased was 16. In Harvest Season 2021, 169 hunters harvested 174 wolves. Based on the total number of hunting tags sold, harvest success was 0.3%. IDFG sold 863 wolf trapping tags in 2021. Wolf trapping tag sales have increased over the last 4 years, but the number of active wolf trappers has remained relatively stable (Figure 6). During the 2021 season there were about 170 active wolf trappers (based on mandatory trapper reporting). Of those, 97 trappers harvested 237 wolves, a 25% success rate based on the number of trapping tags sold. Based on success rates, trapping has been demonstrated to be a more effective tool for harvest than hunting and is a critical tool for population management.

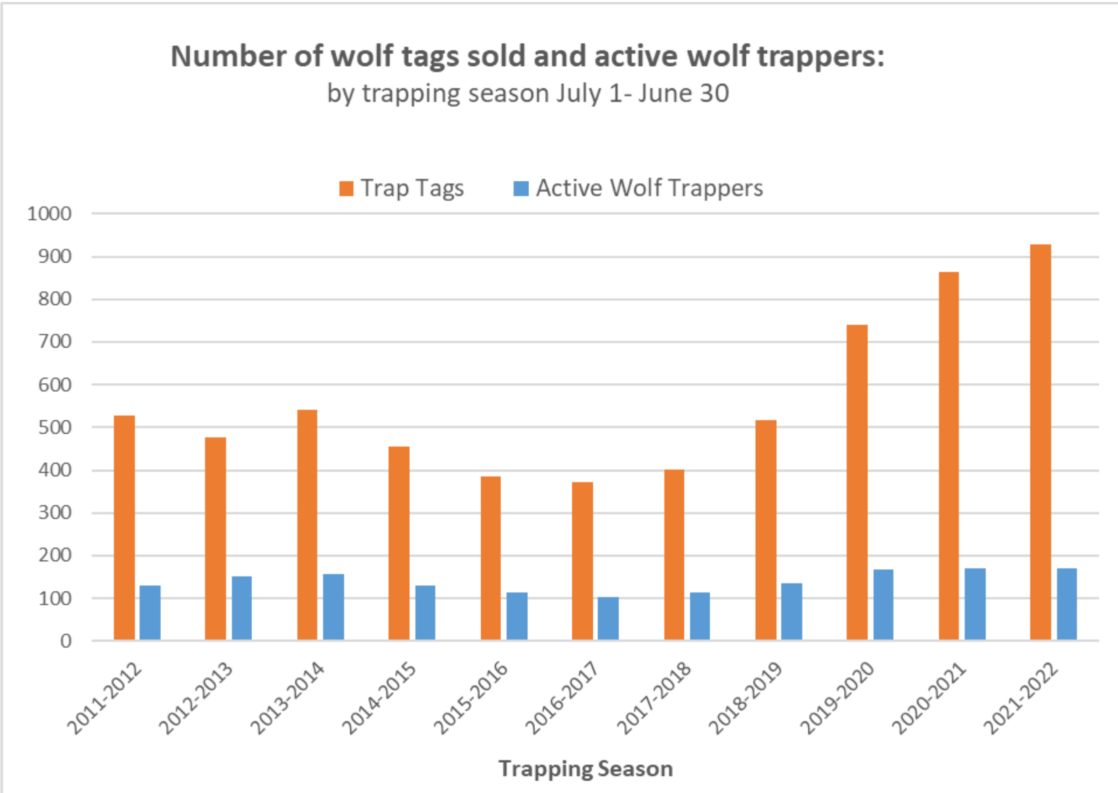

Figure 6. Wolf trapping tags sold and number of active wolf trappers by trapping season, 2011 – 2021.

Wolf Mortality Data

Hunter and trapper harvest is the primary source of wolf mortality in Idaho, and therefore IDFG's most effective management tool for regulating wolf numbers. Before 2019 hunting was the primary mortality agent. Since then, trapping harvest has slightly surpassed hunting harvest. During the past three years (2019 – 2021), trapping harvest increased 91% and hunting harvest increased 18% over the previous three-year average. This increase appears largely due to expanded hunting and trapping opportunities. Hunting harvest primarily occurs incidentally during elk and deer hunting seasons, while trapping harvest occurs primarily during Oct. – Dec. when access and trapping conditions are favorable (Figure 7).

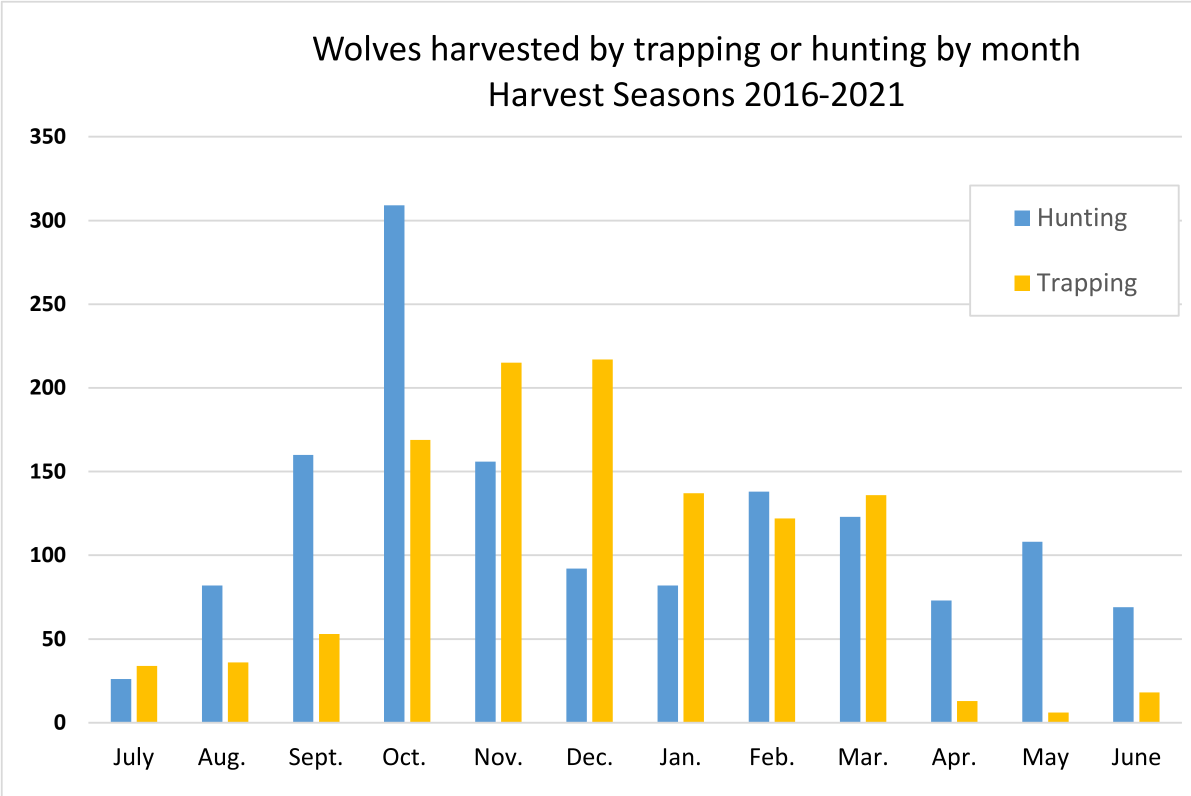

Figure 7. Total monthly wolf harvest through hunting and trapping in Idaho, Harvest Seasons 2016-2021.

More wolves are harvested in the northern half of the state, particularly in well-roaded areas close to population centers (Figure 8). The Panhandle, Clearwater, and Southwest Regions comprised 77% of the total statewide wolf harvest (2016 – 2021; 91% including the Salmon Region).

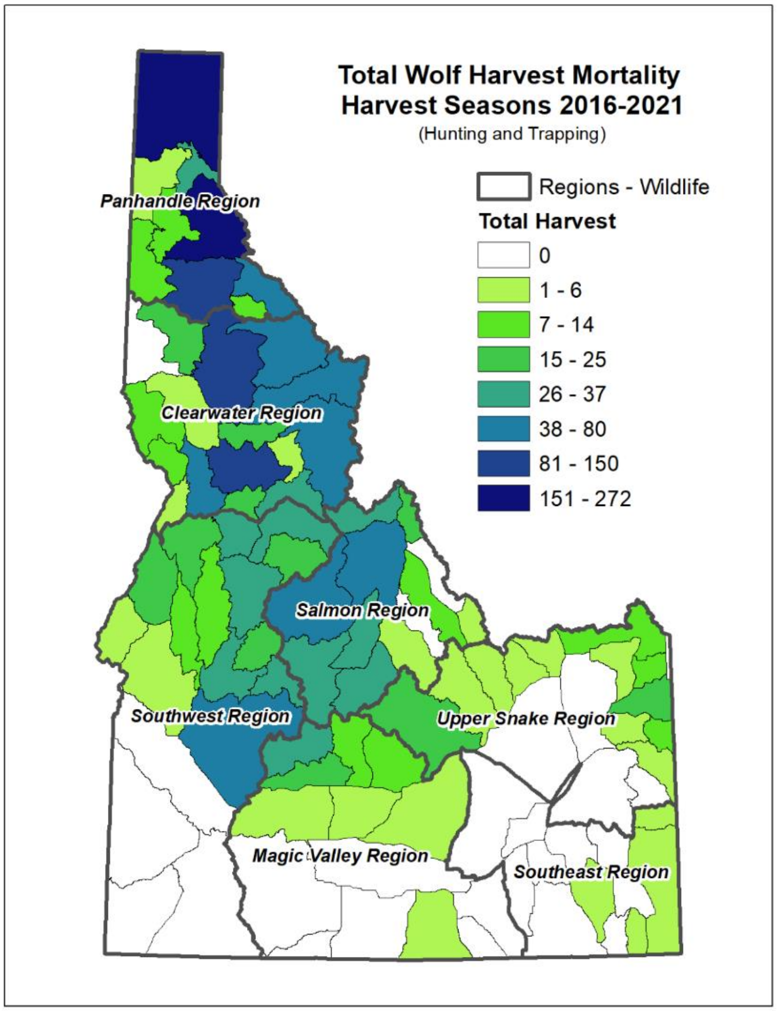

Figure 8. Total harvest from hunting and trapping by Game Management Unit for Harvest Seasons 2016-2021.

Recent Developments in Wolf Harvest

Legislative action in 2021 further expanded the methods of hunting legally allowed for wolves and expanded wolf trapping seasons on private land. During the initial year of implementation, expanded hunting methods do not appear to have had an impact on overall wolf harvest levels. The expanded hunting methods adopted by the Commission resulted in three wolves taken during the 2021 – 2022 harvest season. An additional eight wolves were taken with foothold traps during extended trapping seasons on private property during the 2021 – 2022 harvest season. Hunting and trapping harvest data from Big Game Mortality Reports since July 1, 2021 indicate most wolves are still harvested on public land: 88% of wolves were taken on public land; 10% on private land (including private timberlands that IDFG leases for public access in the “Large Tracts” access program to which public land wolf trapping seasons and rules apply); and 2% on land of undetermined ownership. These percentages exclude control actions for livestock depredations and other non-harvest mortality.

For the past several years, IDFG and the Wolf Depredation Control Board have provided financial support to a private third-party entity that has reimbursed wolf hunters and trappers for their documented harvest-related expenses. Reimbursements are available for wolves harvested in qualifying units that meet IDFG criteria for chronic livestock depredations or where elk populations are below management objectives. Reimbursement may be a valuable tool for focusing and maintaining hunting and trapping pressure in areas with the greatest wolf conflict with ungulates or livestock.

Predation Management

The impact of wolves on their prey is complex and likely varies within their range in Idaho. Elk are the primary ungulate prey of wolves in most of Idaho. Secondarily, wolves prey upon moose, white-tailed deer, and mule deer where their ranges overlap (Husseman et al. 2003). Wolves are opportunists and also prey on many other species, including other predators (mountain lions and bears), beavers, a variety of birds, small game species (e.g., rabbit and hare), and rodents (Husseman et al. 2003, Paquet and Carbyn 2003, Smith et al. 2003).

Kill Rates

Elk comprised about 70% of wolf kills and 78% of the estimated prey consumed by weight in a study in the multi-prey system of Banff National Park (Alberta) where elk were the dominant prey species (Hebblewhite et al. 2003). Overall, estimated kill rates in that study were 0.33 wolf kills/pack/day, with elk comprising 0.23 kills/pack/day and other ungulates (moose, mule deer, white-tailed deer, and bighorn sheep) making up the remainder. The authors estimated that wolves consumed a total of 5.42 kg of prey/day/wolf, 4.23 kg/day/wolf of which was elk. Metz (2012) also estimated wolf kill rates and the weight (kg) of prey acquired per wolf per day in another elk-dominated system in Yellowstone National Park. Wolf use of elk was lowest during the summer (85% of total diet) and increased to ≥96% of the total diet during winter. A key consideration when examining kill rates is that a high kill rate does not necessarily suggest that predators are having a large influence on prey populations, and in fact, can indicate that prey populations are abundant and at high densities (Hebblewhite et al. 2003).

Effect on Ungulate Populations

The impact of wolf predation on ungulate populations varies in Idaho, likely due to factors that include wolf density, density of other predators, prey density and population trajectory, and weather conditions. While estimating kill rate is a way to evaluate the importance of prey species to a predator, predation rate (i.e., the proportion of a prey population killed by a predator) is used to evaluate the importance of predation to the dynamics of a prey population. Horne et al. (2019) calculated annual survival and cause-specific mortality rates from 1,244 adult female and 806 6-month-old calf elk fitted with GPS collars across 29 elk populations in Idaho from 2004 – 2016. Overall annual mortality (excluding harvest) averaged 9% for adult females and 40% for 6-month-old calves. Calf survival was related to their size at capture (i.e., bigger calves survived better), the size of wolf packs in the area (i.e., lower calf survival with larger packs), and snow depth (i.e., lower calf survival with deeper snow in winter). Adult female survival also decreased as wolf pack size and snow depth increased. Of all the calf elk that were monitored, 6.6% were killed by wolves each year. Of all the adult female elk that were monitored, 3.5% were killed by wolves each year The analysis also suggested an interacting effect of wolf pack size and snow depth on elk survival, where changing conditions from shallow snow with small wolf packs to deep snow with large wolf packs approximately doubled the risk of elk mortality. The interacting effects of changes in wolf pack size and snow depth are substantial and could reverse an elk population's trajectory from growing to declining (Raithel et al. 2007).

The effects of wolves and snow observed for Idaho elk were similar to other studies that have shown lower elk survival rates in the presence of wolves, especially when facilitated by deep snow. In a study of adult female elk survival across western North America, Brodie et al. (2013) determined mortality rates were related to the presence of wolves, especially during harsh winters. In northern Yellowstone, Evans et al. (2006) reported annual survival of adult female elk to be relatively low (83%), with wolves accounting for about one-third of mortalities. Over a period of mild winters, Barber-Meyer et al. (2008) observed relatively high overwinter survival of calves in Yellowstone National Park (approximately 85% survival; 2% mortality from wolf predation).

The effect of wolf predation on ungulate populations can be complex (Mech and Peterson 2003). In some areas, wolf predation can have an additive effect on ungulate mortality (i.e., ungulates that died from wolf predation would have otherwise survived) and in other instances wolf predation can be compensatory (i.e., ungulates that died from wolf predation would have died from another cause if not killed by wolves; Horne et al. 2019, Lukacs et al. 2018). Although wolves do kill healthy adult animals, they often kill the young and/or weak individuals first, because these individuals are easier to capture and present less risk of injury than mature, healthy adults (Smith et al. 2004). Wolf predation rate on newborn calf elk is generally low (4% 3-month wolf mortality rate; Griffin et al. 2011) and at least partially compensatory; therefore, it is unlikely that wolf predation on newborn elk has a large effect on elk population dynamics (Lukacs et al. 2018). However, predation by wolves during winter on 6-month-old calves and adult females could have a substantial effect on elk abundance because of the importance of those life stages for elk population growth (Raithel et al. 2007).

The overall effect of wolf predation on ungulates also depends on what other predator species exist in an area. In most of Idaho, mountain lions and black bears overlap with wolves, and in a smaller portion of the state, grizzly bears are also present. Griffin et al. (2011) showed that the composition of predators in the environment was important to newborn elk calf survival, and its potential influence on elk population dynamics. Several recent studies have explored the interactions of wolves and mountain lions (e.g., Atwood et al. 2009, Elbroch et al. 2020) and wolves and bears (e.g., Elbroch et al. 2015, Tallian et al. 2021) and the effects of those interactions on predation rates. One of the questions currently being investigated by IDFG is how predator management influences prey and other predator populations.

Elk populations in Idaho are limited by a variety of factors, and it is ultimately the combination of habitat quality, predation, and other prominent influences, such as hunting and winter severity, that determine the population dynamics of Idaho elk (IDFG 2014). Predation is identified as a prominent factor limiting 5 elk populations, located primarily in central Idaho (IDFG Predation Management Plans: Panhandle, Lolo, Selway, Middle Fork, Sawtooth). In these zones, IDFG has developed and implemented predation management plans under IDFG's Policy for Avian and Mammalian Predation Management (IDFG 2000). These plans encourage increased predator harvest through Commission implementation of longer seasons, expanded methods of take, and increased tag numbers for bears and mountain lions. However, management of predation exclusively through harvest is difficult in portions of these zones due to limited access. IDFG has implemented supplemental wolf removal in 2 of these zones to help reduce the impact of wolves on elk.

Wolf Related Livestock Conflicts

Wolf related livestock depredations occur primarily in the central and eastern parts of Idaho (Figure 9). The relatively low frequency of depredations in northern Idaho is associated with less livestock production/grazing, whereas the low frequency of wolf-caused livestock depredations south of the Snake River is associated with the relative absence of wolves.

Confirmed depredations attributable to wolves increased steadily after reintroduction in 1995, but after implementation of hunting and trapping, depredations declined. The number of depredations USDA Wildlife Services has been called to investigate and the total number of cattle killed has been declining since 2019 (Table 1). The number of total livestock losses is heavily influenced by sheep losses which can vary dramatically if a "pile-up" occurs. Sheep losses have also been trending downards, except for one recent incident in 2022 in which 143 sheep were killed in a wolf-caused pile up (Table 1). Since delisting, removal of wolves in response to livestock depredations has declined from a peak of 95 (2008) to 30 wolves in 2021 (USDA Wildlife Services, unpublished data, 2022). Total documented wolf mortality, however, has increased, mostly driven by increased harvest mortality.

Wolf-caused mortalities are difficult to detect in forest and range livestock areas. Heavy cover, large pastures, significant topographical variation and complete carcass consumption by wolves and scavengers make it difficult to detect wolf kills in time for a sufficient necropsy. Some losses may be associated with livestock being harassed or injured by wolves even if they are not mortally wounded, and some losses are incurred but never discovered (Oakleaf et al. 2003). The proportion of wolf-related depredations that go undetected or unconfirmed is unknown.

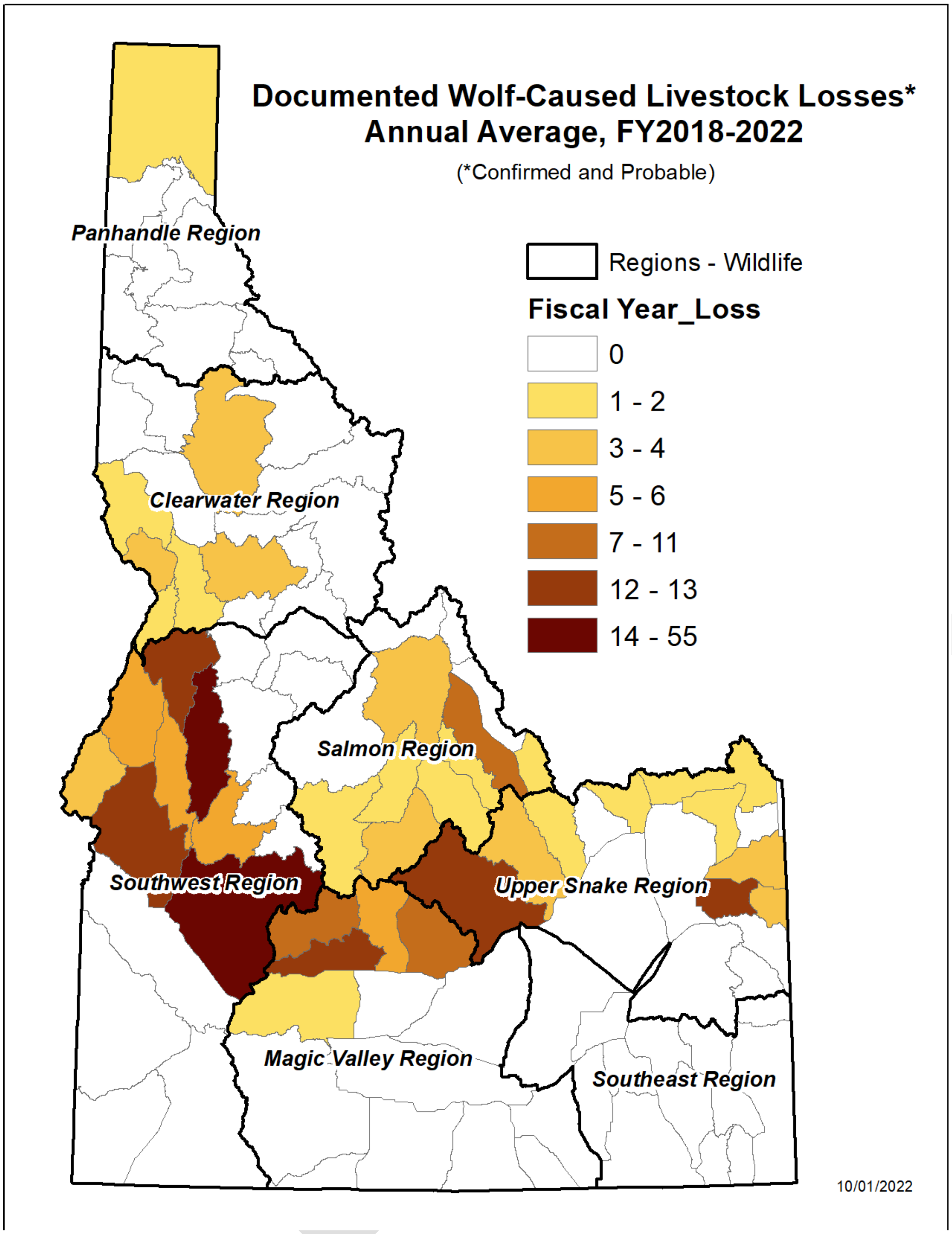

Figure 9. Average annual documented wolf-caused livestock losses (injured or killed) per GMU; determined by USDA Wildlife Services investigations (confirmed and probable); 2018 − 2022 (fiscal year July 1, 2017 − June 30, 2022).

Table 1. Summary of USDA Wildlife Service's wolf-caused livestock depredation investigations and documented wolf mortality in Idaho, Fiscal Year (July 1 – June 30) 2015 – 2022. Documented wolf mortality represents a minimum number of actual depredation loss and these numbers serve as an index of relative rates of depredation.

Fiscal Year	Confirmed and Probable						Total Documented Wolf Mortality*	Wolf Harvest	USDA Wildlife Services Wolf Removal
	USDA-WS Investigations	Livestock Losses	Cattle	Sheep	Dog	Other			
2015	86	170	62	101	4	3	360	250	45
2016	73	204	61	139	4		384	272	68
2017	90	184	83	93	8		292	231	45
2018	159	297	125	169	3		441	333	82
2019	191	313	177	123	5	5	385	315	56
2020	136	211	122	79	7	3	585	462	95
2021	124	198	110	81	4	3	477	412	30
2022	93	279	84	192	1	2	486	413	38

*All causes of mortality

Depredation Prevention, Compensation, and Control

Wolf recovery has had negative financial impacts on individual livestock producers. These impacts include uncompensated predation losses, reduced productivity related to stress on livestock, and increased personnel costs associated with livestock protection and management. The Idaho Governor's Office of Species Conservation (OSC) implements a federally funded program to compensate livestock owners for their losses. OSC also implements a federally funded prevention program to help willing landowners implement measures to decrease the risk of wolf-livestock interactions and reduce the extent of livestock losses caused by wolves.

Table 2 shows the number of livestock, producers, and compensation amounts for the individuals or ranches that received compensation through the program for livestock losses due to wolves. It is important to note that Total Compensation is the total amount compensated; in some years, funding was insufficient to compensate landowners for the total value of their losses. Therefore, these values do not reflect the total estimated monetary loss.

Table 2. Compensation summary for Idaho verified livestock losses 2014 – 2022 and the overall value they were compensated at between 2014 and 2022 through the State of Idaho's Compensation Program.

Grazing Yr.	Calves	Cows	Bulls	Sheep	Dogs	Horses	Bison	Llamas	Verified Losses	Producers	Total Compensation
2014	20	4	0	17	2	0	0	0	43	16	$36,475.00
2015	22	3	0	82	1	1	0	0	109	16	$36,370.00
2016	23	12	1	85	3	0	0	0	124	22	$54,305.00
2017	59	32	5	149	2	0	1	0	248	49	$150,591.00
2018	55	58	1	90	5	1	0	3	213	44	$123,498.00
2019	49	26	3	17	0	0	2	0	97	40	$90,000.00
2020	47	29	2	67	1	1	2	0	149	43	$98,122.00
2021	40	27	0	38	2	0	1	0	108	41	$97,668.50
2022	12	17	1	168	0	2	0	0	200	28	$94,060.36
Total	**327**	**208**	**12**	**713**	**16**	**5**	**6**	**3**	**1,291**	**299**	**$687,029.50**

*Years 2014 – 2019 include confirmed and probable kills verified by USDA Wildlife Services.
*Years 2020 – 2022 are only for confirmed kills due to USFWS funding requirements.

Under Idaho law (Idaho Code 36-1107, Wild Animals and Birds Damaging Property), livestock and domestic animal owners, their agents, or agency personnel may kill wolves that are molesting or attacking their animals without a permit, provided they timely report the killing to IDFG. Livestock owners must obtain a permit from IDFG to control wolves not actively molesting or attacking livestock or domestic animals.

Idaho Code 36-1107 also authorizes IDFG to conduct or authorize control actions to kill wolves to address wolf depredation on livestock or prevent its recurrence. USDA Wildlife Services is the primary agency that works with livestock producers to investigate and control depredation on livestock by wolves with IDFG authorization. USDA Wildlife Services agents are experienced at investigating livestock deaths, and livestock producers often call these agents first when they suspect predation.

To ensure adequate funding after federal delisting for wolf control activities to protect livestock and address impacts to ungulate herds, 2014 state legislation created the wolf control fund (Idaho Code 22-5304). The wolf control fund receives money from fees assessed on cattle and sheep producers, sales of fishing, hunting and trapping licenses, and the state's general fund. The 2014 legislation created the Idaho Wolf Depredation Control Board (WDCB) within the Office of the Governor to administer the wolf control fund. The WDCB must follow Commission direction regarding the expenditure of funds from fishing, hunting, and trapping licenses.

Since the wolf control fund was created, expenditures have supported agreements with USDA Wildlife Services to investigate and respond to livestock depredations, and to perform radio-collaring to help deter or resolve wolf-livestock conflicts. Wolf control fund expenditures have also supported agreements with IDFG to perform work related to ungulate predation and to support nonprofit organization reimbursement of hunter and trapper expenses in successful harvest of wolves in GMUs with chronic livestock depredation or where elk herds are below objective.

Domestic Dogs and Wolves

Wolves frequently defend their territories from other canids and often see dogs as competition or trespassers (Fritts et al. 2003). Wolves may be aggressive and defensive towards dogs at any time, but especially during breeding season (January – February) and the denning period (April – May) when pups are nearby. Free ranging hunting dogs, such as hound dogs, are most at risk because they typically roam long distances from their owners and are often pursuing game in wolf habitat. Livestock protection dogs are also at high risk because they guard livestock which is prey for wolves in remote locations away from human activity and presence.

Direct Interactions with Humans

Wolf attacks on humans by wild, healthy wolves are rare in North America and fatal attacks occur but are very rare (Fritts et al. 2003, Linnell et al. 2002, McNay 2002). Wolves that are rabid, habituated to humans, defending themselves or other wolves, or responding to the presence of domestic dogs are more likely to act aggressively or possibly attack (Linnell et al. 2002, McNay 2002).

Wolf Population Monitoring

Population monitoring

Monitoring wolves and other large carnivores in a cost-effective manner is particularly challenging because they occur at low densities in comparison to ungulate species, often reside in remote and difficult-to-access areas, and generally avoid human contact. In the years following reintroduction, wolf monitoring was focused on USFWS delisting criteria (15 breeding pairs and 150 individuals). Counts of both packs with pups and the number of wolves were used to ensure that USFWS delisting criteria were maintained. As Idaho's wolf population grew and the population far exceeded USFWS minimum thresholds, IDFG wolf monitoring approaches shifted toward different methods that provided a fuller picture of the statewide distribution and abundance of wolves. IDFG is currently exploring new, cost-effective approaches that will streamline wolf monitoring and potentially provide estimates of abundance at smaller scales to increase IDFG's ability to effectively monitor and manage wolves.

History of wolf monitoring in Idaho

Initial efforts to monitor wolves in Idaho relied primarily on capturing and radio-collaring wolves. Radio-collared wolves were used to locate packs to determine reproductive success and count the number of individuals in each pack. As the wolf population grew, it became increasingly difficult to get an accurate count of wolves for every pack, thus from 2006 – 2016 average pack size was calculated and extrapolated to the total number of known packs to project to a statewide estimate of wolves. The methodology considered total number of documented packs, mean pack size (calculated from all packs for which biologists had a high degree of confidence that all pack members had been counted over multiple observations), the number of wolves in small groups not considered packs, and an adjustment for an estimated percentage of the population presumed to be lone wolves (IDFG 2015). Monitoring biologists also confirmed reproductive status of individual packs from observations throughout the year and reported the minimum number of “breeding pairs” based on the number of packs with ≥2 adults and ≥2 pups surviving through Dec 31 each year.

Given the difficulty and cost in capturing wolves and maintaining a large number of active radio-collared wolves, noninvasive genetic sampling was tested as an alternative approach in several GMUs (Stenglein et al. 2010). Wildlife technicians searched randomly selected, predicted rendezvous sites for wolf scats. DNA from wolf scats was used to identify the number of unique, individual wolves in each pack. Although noninvasive genetic sampling produced an accurate count of wolves where it was implemented, the cost of the approach made it impractical to deploy at a statewide scale.

To gain a better understanding of wolf distribution, IDFG combined use of multiple survey techniques and occupancy modeling. Occupancy models rely on presence and absence data and landscape covariates to first determine the probability of detecting a species if it is present in an area (i.e., probability of detection), which enables the model to predict the additional areas where the species was present, but not detected. Ausband et al. (2014) detailed the use of radio-collared wolves and pack counts, noninvasive genetic sampling of rendezvous sites, and hunter sightings of wolves to model statewide wolf occupancy. IDFG divided the state into a grid of cells that each approximated the average size of a wolf pack territory, and cells known to be inhabited by wolf packs were identified. Landscape characteristics of those cells were then extrapolated across the state to predict occupancy statewide, which was then multiplied by mean wolf pack size (derived from winter counts of radio-collared wolf packs).

The resulting wolf abundance estimates for 2009 and 2010 based on multiple survey techniques were similar to winter pack counts via tracking radio-collared wolves. However, the approach still required radio-collaring wolves and conducting winter pack counts to estimate mean pack size (or an assumption of constant, yearly, mean pack size) to generate an abundance estimate, an approach that proved unsustainable as Idaho’s wolf population grew.

Current Approaches

Radio-collaring

Although radio-collaring and pack counts are no longer used to estimate minimum counts, radio-collaring remains a useful tool to understand and respond to livestock depredations. IDFG, in association with other state and federal partners, continues to collar wolves in areas with high depredation risk to better understand where and when depredations occur and to facilitate removal of offending individuals and packs when necessary.

Camera Arrays

IDFG continues to use occupancy models to monitor yearly changes in wolf distribution, but now utilizes camera traps to collect data on wolf presence. Camera traps have been established as an effective tool for monitoring wildlife populations (Rowcliffe and Carbone 2008) and allow for a consistent spatial and temporal sample. Since 2016 camera traps have been randomly placed within 209 of the cells laid out in the original occupancy analysis grid. Each camera trap is set to take three images whenever a camera detects movement within its viewshed (i.e., motion trigger) and is active June 15 – Sept 31. All images are screened, and images of wolves are used as the response variable in the occupancy model. Statewide occupancy estimates of viable wolf habitat have remained relatively constant, ranging from 0.39 – 0.44 (Figure 10), suggesting that wolves have occupied between 39% and 44% of viable habitat from 2016 – 2021. An occupancy estimate for 2022 is currently in development.

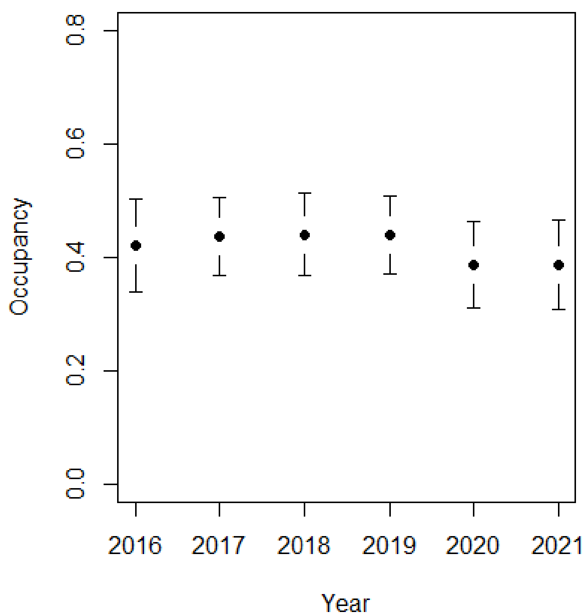

Figure 10. Predicted occupancy (and 95 % confidence intervals) for gray wolves in Idaho from 2016 – 2021 using a multi-year, dynamic occupancy model.

In 2019 IDFG began to generate a statewide wolf abundance estimate using camera traps and space-to-event (STE) modeling (Moeller et al. 2018). Although methods to estimate population abundance using camera traps are still in development, STE modeling is one of the more established methods in the literature (Moeller et al. 2018, Ausband et al. 2022). Because abundance estimation requires a denser camera trap grid than occupancy monitoring, IDFG selected a spatially balanced, random sample of cells for more intensive sampling. Each selected cell (n = 37) was split into 16 subcells (~43 km^2) and a camera trap was placed within each subcell where possible (e.g., federal wilderness designation and private property prevented placement of cameras in some subcells). On average, over 560 cameras were deployed each year for abundance estimation. Camera traps are active July 1 – Aug 31 after which all wolf pictures are identified.

The STE model is based on sampling space (i.e., the viewshed of each camera trap) until a wolf is detected. For every 30 second timepoint, cameras are randomly selected until an image of a wolf is found, which generates an "area until detection" for each time point. The amount of area sampled at each time point until a wolf is detected (i.e., space-to-event) is then incorporated into the space-to-event model to estimate the number of wolves detected across all the sampled space across all cameras, otherwise known as the density of wolves. Assuming that the density is equal between the sampled (i.e., area within the camera viewsheds) and non-sampled areas, statewide abundance can be determined by extrapolating the density in the sampled areas to the non-sampled areas. This results in an abundance estimate for all viable wolf habitat in the state. From 2019 – 2021, statewide annual wolf abundance estimates were highly consistent and ranged from 1,543 – 1,556 wolves; the estimate dropped slightly to 1,337 wolves in 2022 (Figure 11). Details on IDFG's wolf abundance estimation methods are documented in Thompson et al. 2022.

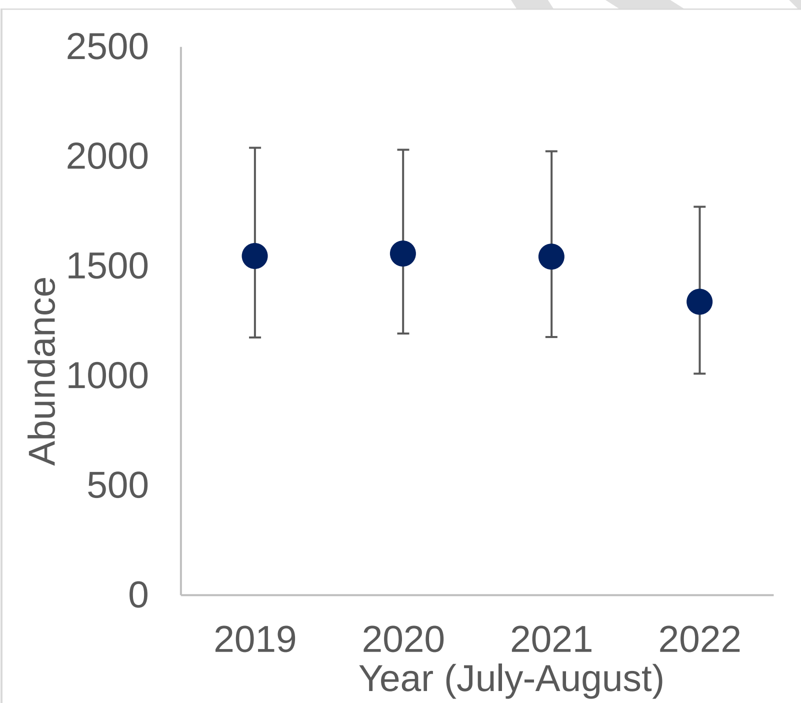

Figure 11. Predicted summer abundance (and 95 % confidence intervals) for gray wolves in Idaho from 2019 – 2022 using camera trap images and space-to-event models.

To visualize seasonal fluctuations in wolf abundance, IDFG built a population projection using existing data. The primary objective of this projection was to better visualize annual variation in wolf abundance due to reproduction and mortality and how that would result in differences between abundance estimates generated in winter—like those generated previously in Idaho via radio-collars and pack counts—and the current summer abundance estimates generated using camera traps. The projection starts with the first camera trap estimate in August 2019 (1,545 wolves). Abundances after August 2019 were projected using documented human-caused mortality (i.e., harvest, conflict removals, vehicle collisions, etc.) combined with constant values of adult and pup natural mortality (21% and 40%, respectively; Smith et al. 2010, Ausband et al. 2015), portion of wolves not associated with packs (15%), average adults per pack in spring (5), and average pup production per pack (6.2; calculated by taking midpoint between high and low estimates of mean number of pups per group in Idaho at 3 months of age in Ausband et al. 2017 [5.5] and back-calculating expected number of pups in den based on monthly natural mortality rate of pups from Ausband et al. 2015). These values are either within the biological ranges documented in the literature or from prior research in Idaho. Although the subsequent projection does not exactly align with the 2020 - 2022 summer abundance estimates, the projected abundances are well within the confidence intervals of the 2020 - 2022 summer abundance estimates. The projection suggests that the population fluctuated around an average of approximately 1,270 wolves at the November midpoint from 2019 - 2021, from a high in May of about 1,600 individuals to a low in April of about 850 individuals (Figure 12).

Genetic Sampling

Earlier efforts using noninvasive genetic sampling to estimate abundance were discontinued, but genetic approaches have continued to be used to document that the number of breeding pairs exceeds the minimum number required. Teeth are collected from legally harvested wolves and from wolves removed in response to depredations. DNA is extracted from soft tissue that is scraped from each tooth, and the teeth themselves are sent off for aging (Matson's Laboratory, MT, USA). Genetic markers (Clendenin et al. 2020) are used to genotype each individual, which allows IDFG to determine how closely individuals are related to each other, and to identify sibling groups. Individuals that are less than one year of age (i.e., young of year) are grouped with other individuals that share approximately half of their DNA, which is the expectation for siblings. The number of sibling groups identified indicates a minimum count of the number of reproductive events that have occurred in the past year. Estimates for 2020 - 2022 are still pending, but prior estimates demonstrated a minimum number of breeding pairs ranging from 39 to 97 (Table 3). Estimation of the minimum number of breeding pairs using this method depends on the number of young of year harvested and successfully aged and genotyped.

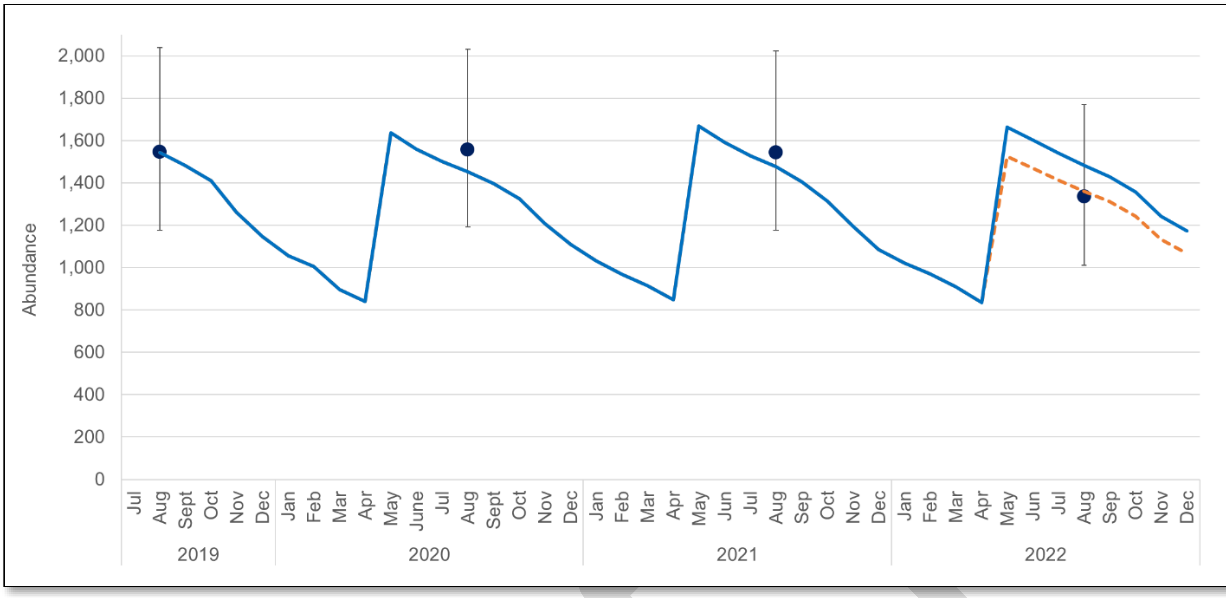

Figure 12. August 2019-2022 camera-based abundance estimates (points w/ 95% confidence intervals) and a projection of potential annual fluctuations in statewide wolf abundance, initiating from the August 2019 camera-based abundance estimate. The blue line projection uses documented monthly human-caused mortality combined with constant rates of adult and pup natural mortality, portion of wolves not associated with packs, average adults per pack, and average pup production per pack that are within the biological ranges documented from prior research in Idaho and other western states. The orange dashed line shows the effect of decreasing the value used for average reproduction by 1 pup/pack in 2022 on the resulting projection.

Table 3. Number of harvested young of year successfully genotyped and the estimated number of sibling groups.

Year	2014	2015	2016	2017	2018	2019
Young of year genotyped	98	105	77	123	134	199
Minimum # of breeding pairs documented	53	63	39	59	76	97

Wolf monitoring in adjacent states

Montana Fish, Wildlife, and Parks (MFWP) recently developed an integrated patch occupancy model to predict abundance and monitor gray wolf population trends (Sells et al. 2022). The model relies on public sightings of wolves while accounting for false positives to estimate occupancy. This model also integrates separate models that predict territory and pack size using environmental covariates, such as harvest, human density, and ecotype. The integrated model framework estimates annual wolf abundance by considering which areas wolves are present (occupancy model) and the predicted size of wolf pack territories and predicted number of wolves in each pack from those areas. A strength of the model is its reliance on opportunistic data collection in the form of wolf sightings by hunters and other outdoor recreationalists. A potential limitation of the approach is the assumption that relationships among territory size, pack size, and environmental covariates remain constant through time, as changes in these relationships could bias the abundance estimate.

The Oregon Department of Fish and Wildlife (2022), Washington Department of Fish and Wildlife (2019), and Wyoming Department of Game and Fish (2022) all currently generate minimum counts of wolves using a combination of collaring wolves, observing and counting wolves via aerial surveys, ground surveys, and camera traps.

Future development

As the wolf population in Idaho has increased through time and wolf monitoring approaches have advanced, IDFG has continued to evaluate new methods to generate reliable, cost-efficient estimates of wolf distribution and abundance. Although the current approaches using camera traps for estimating wolf distribution and abundance have proven useful, their utility is limited, given that neither estimate can determine changes in wolf abundance at smaller spatial scales that might inform local management actions. Further, these approaches are costly and very labor intensive due to the large number of camera traps that are deployed each year.

To provide estimates of wolf abundance at a smaller spatial scale and to reduce personnel costs, IDFG is currently examining the use of integrated population models (IPMs) (Besbeas et al. 2002; White and Lubow 2002). An IPM is a type of population model that relates vital rates (such as birth, death, immigration, and emigration rates) to changes in population abundance from one year to the next. In contrast to a non-integrated population model, an IPM can adjust vital rate estimates using information from other data in the model. The other data inputs help to account for sampling uncertainty by determining the most likely values for all population parameters simultaneously.

A statistical population reconstruction (SPR) model is a specific type of IPM-based on age-at-harvest data, along with other information on hunter effort, harvest rate, survival, and/or abundance to estimate population parameters. A wide variety of species (e.g., ungulates, carnivores, and game birds) have been modeled using SPR (Clawson et al. 2017). Given multiple years of data, the minimum number of animals alive in any year can be reconstructed because any individual greater than one year of age that was harvested must have been alive in the previous year. When combined with additional data, SPRs can be used to estimate yearly abundance, survival, harvest rates, and other population parameters of interest. In general, IPMs based on SPR require a considerable amount of data collected over multiple years. IDFG is in the process of determining if sufficient wolf data are available to build an IPM that generates reliable estimates of yearly abundance, and if the data collection necessary to maintain the IPM is feasible from a cost standpoint.

Concurrently, IDFG is evaluating MFWP's integrated patch occupancy model as a potential alternative approach to estimating statewide wolf abundance. A model of this nature would be based on the IDFG's current efforts using camera traps and occupancy modeling but would need to be supplemented with additional data on territory size and pack size models that have yet to be developed. An integrated patch occupancy model would likely provide some cost savings, dependent on the ability to use existing data from radio-collared wolves to build accurate models for predicting territory and pack sizes. IDFG would also have to consider the potential limitations of an integrated patch occupancy model if it requires that relationships among territory size, pack size, and environmental covariates remain constant through time.

Statewide Wolf Management Direction

IDFG is committed to maintaining a viable, self-sustaining wolf population well-distributed in suitable habitat throughout the state at a level that minimizes conflicts with both livestock and ungulate populations. IDFG is also committed to maintaining connection with wolf populations in Montana, Wyoming, Oregon, Washington, and Canada. Management will be closely monitored and regulated to maintain annual abundance and reproduction that stays well above the USFWS's 2009 recovery/delisting criteria (>150 wolves and >15 breeding pairs with ≥2 pups at year end).

Idaho's wolf population has exceeded delisting criteria established by the USFWS since 2002, well before the original delisting in 2008. Intensive population monitoring from 2019, 2020, and 2020 indicates Idaho's wolf population fluctuated around 1,270 wolves annually during that period, varying from a high of around 1,600 following reproduction in the spring to a low of around 850 just prior to denning. In the 2009 delisting rule (USFWS 2009), USFWS recognized that after delisting wolves in the NRM DPS would be managed by the states, National Park Service, and USFWS in their respective jurisdictions to average over 1,100 wolves, fluctuating around 400 in Montana, 500 in Idaho, and 200-300 in Wyoming. Above this level, the USFWS stated, conflicts would be expected to increase as wolves occupied more unsuitable habitat. The USFWS further contended it would be difficult to maintain the wolf population above 1,500 wolves in the NRM because suitable habitat would be fully occupied and packs attempting to colonize unsuitable habitat would cause chronic conflict with livestock and long-term detrimental impacts to their ungulate prey base (USFWS 2009).

The wolf population in Idaho alone exceeds what the USFWS considered to be the carrying capacity of wolves in the entire NRM DPS. At this high level of abundance in Idaho, wolf predation has contributed to substantial declines in elk and moose populations, and chronic conflicts with livestock have been significant, with nearly 1,300 verified livestock losses affecting 299 producers since 2014. We know these verified losses represent only the minimum of total wolf-related losses.

Wolves have been resilient to past level of human-caused mortality. Despite nearly annual incremental adjustments to liberalize harvest opportunities since the first hunting and trapping seasons were opened in 2009 and 2011, respectively, Idaho's wolf population remained stable or increased. USFWS stated in 2020 (USFWS 2020) that "the wolf population in Idaho appears to be resilient to the increased level of human-caused mortality in the state."

Wolf monitoring efforts have evolved since delisting and now include multiple data streams that can be compared to provide checks and balances, and ensure confidence in abundance estimates, pack and litter size estimates, and harvest data. IDFG is committed to maintaining and improving monitoring efforts, to better detect and track annual changes in wolf populations.

Idaho's wolf management goals are intended to support the four goals stated in IDFG's Strategic Plan. Species-specific management goals and direction statements provide more specific management strategies, after considering current data, public input, agency resources, and resource opportunities and challenges relative to wolf management. The goals and associated management direction in the plan are intended to serve as long-term guidance for IDFG wolf management, while strategies describe steps to achieve these goals.

GOAL: Manage for a stable, well-distributed, self-sustaining Idaho wolf population that fluctuates around an average of 500 animals annually. The population would be expected to range from a high of about 650 wolves following reproduction in the spring, reach the mid-point of around 500 in November, and decline to a low of about 350 wolves just prior to the reproductive pulse the following year (Figure 13).

Management Direction: Increase wolf mortality to reduce the population towards the goal of fluctuating around 500 wolves by the end of this 2023 – 2028 planning cycle.

Strategy: Continue to use public hunting and trapping as the primary tool for managing wolves. Maintain current public harvest opportunities (e.g., long seasons, no personal bag limits, no area-specific harvest limits) until wolf population is reduced to the goal.

Strategy: Incentivize increased public harvest by supporting third-party agreements that reimburse licensed hunters and trappers for expenditures related to their successful harvest. Third-party reimbursements paid from IDFG funds would be limited to Game Management Units specified by IDFG and focused on units with chronic livestock depredations or units where ungulate populations are limited by predation and below Commission-adopted objectives.

Strategy: Provide long-duration and geographically broad agency control authorizations to conduct wolf removals to resolve or prevent livestock depredations in areas with a history of livestock losses or in other unsuitable habitat where depredations may occur.

Strategy: If the combination of public harvest, depredation control actions, and natural mortality is insufficient to reduce wolf numbers, implement supplemental agency-directed control actions focused where wolves are having unacceptable impacts on ungulate populations or livestock, or where wolves become established outside of suitable habitat.

An average of 516 wolves died annually from all documented mortality causes combined during 2019-2021, a mortality rate of approximately 33%, yet annual reproduction during those years appeared to have replaced the mortality resulting in a stable population above the management objective. The summer 2022 estimate was slightly lower and one potential explanation for the apparent reduction in abundance could be a decrease in reproductive success due to smaller pack sizes (Ausband and Mitchell 2021). If we modify the value used in projections for average number of pups produced per litter, so the resulting projection aligns with the summer 2022 abundance estimate (reduction of 1 pup born per litter), we can project how both reduced reproduction and hypothetical future harvest rates may affect population trajectory. To reduce the wolf population from its summer 2022 level to the goal of fluctuating around an average of about 500 wolves by the end of this planning cycle (2028), the projection indicates wolf mortality may need to be increased up to about 37% of the population annually for 6 years (Figure 13). For harvest year 2023-2024, this would translate to a documented mortality total of 513 wolves. This projection is based on the previously described metrics used for population projection, the reduced reproduction metric described above, and hypothetical harvest rates to decrease and then stabilize statewide abundance. The actual annual harvest rate needed to meet management objectives may change due to changes in wolf vital rates and will be calculated annually.

The Commission sets big game seasons biennially by schedule, but wolf population abundance will be monitored annually and mortality from human-related causes will be tracked in near-real time. IDFG will update the Commission regularly and propose adjustments to seasons, bag limits, methods of take, as well as modifications to livestock depredation response or other IDFG-directed control actions as necessary to ensure progress toward the goal. Upon achieving the desired population objective, mortality rates would be adjusted to ensure the population stabilizes and fluctuates around 500 wolves.

The Commission has authority to adopt emergency closures or restrictions on hunting and trapping at any time for preservation, protection or management of wildlife (Idaho Code §36-104(b)(3)). The IDFG Director is provided with similar emergency authority "to close any open season or to reduce the bag limit or possession limit … if at any time any species of wildlife of the state of Idaho shall be threatened with excessive shooting, trapping, or angling, or otherwise …" (Idaho Code §36-106(e)(6)). The Commission has discretion under Idaho Code 36-104(b)(2) and 36-104(b)(3) to adopt more restrictive seasons or methods if take of wolves is greater than expected.

Use of poisons is tightly restricted by the U.S. Environmental Protection Agency. Poisons will not be used to manage the wolf population in Idaho.

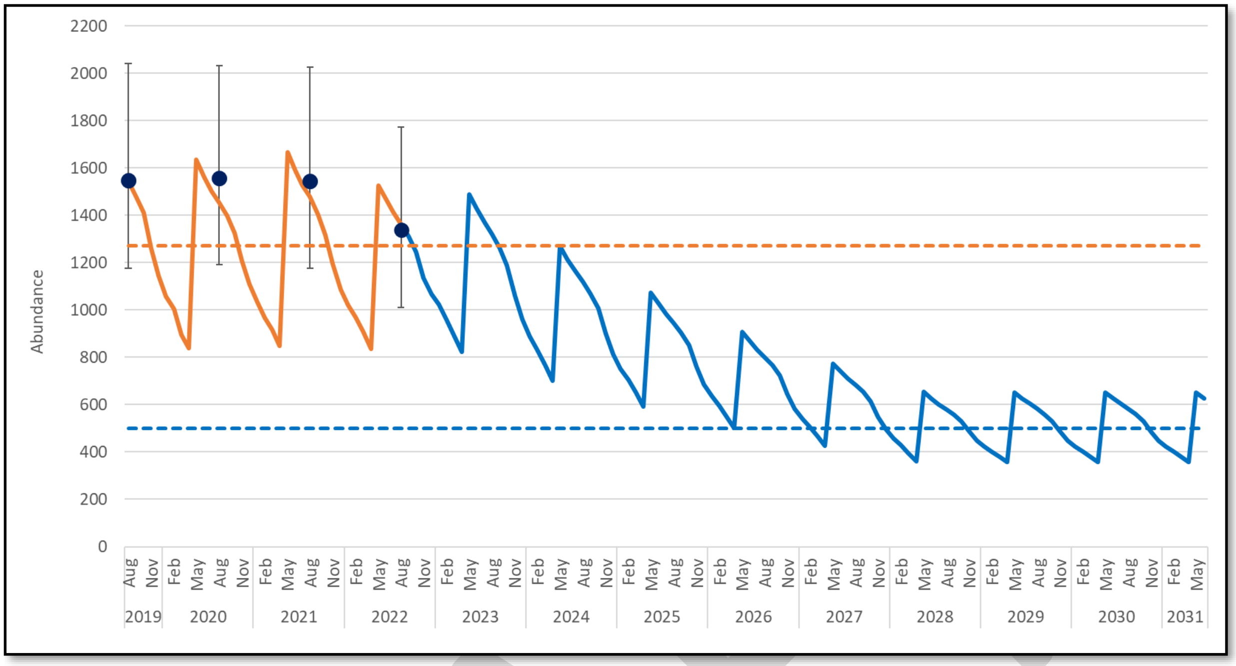

Figure 13. August 2019-2022 camera-based abundance estimates (points w/ 95% confidence intervals) and a projection of potential annual fluctuations in statewide wolf abundance, initiating from the August 2019 abundance estimate. The solid orange portion of the projection line uses documented monthly human-caused mortality combined with constant rates of adult and pup natural mortality, portion of wolves not associated with packs, average adults per pack, and average pup production per pack for 2019-2021 that are within the biological ranges documented from prior research in Idaho and other western states. The dashed orange line represents the average projected abundance during 2019-2021 (1,270). For 2022-2031, the average pup production per pack used in the projection was reduced to reflect a potential reduction in reproductive output that may explain the decline in abundance from 2021 to 2022. The solid blue portion of the projection line shows the potential annual fluctuation in abundance under an increased harvest scenario designed to reach an average annual population of approximately 500 by 2028 (dashed blue line = average of 500).

Management Direction: When the wolf population approaches the goal of fluctuating around 500 wolves, modify management actions to stabilize the population at this lower level.

Strategy: Strategically adjust hunting and/or trapping seasons on public land.

Strategy: Focus IDFG support of hunter and trapper reimbursement programs on areas where ungulates are not meeting population objectives and areas where livestock operators are experiencing high rates of wolf depredation.

Strategy: Collaborate closely with on control action authorizations to continue to address livestock depredations.

Strategy: Continue to focus agency-directed control actions in specific areas to alleviate wolf impacts on ungulates or chronic livestock depredation areas.

GOAL: Monitor wolf population annually to assess mortality, abundance, and reproduction. Continue to improve wolf monitoring techniques.

Management Direction: Continue implementation of camera-based occupancy modeling and estimation of abundance (unless/until replaced with new techniques with demonstrated better precision and/or efficiency).

Strategy: Evaluate current camera arrays, in combination with other population monitoring techniques (DNA, radio-collaring, population modeling), to maximize efficiency and accuracy of camera-based population estimates.

Management Direction: Maintain mandatory check requirement for harvested wolves and requirement for reporting wolves killed in control actions or for property protection.

Strategy: Collect premolar from each wolf to provide data about population age structure.

Strategy: Collect DNA sample from each wolf to inform modeling of pack and litter sizes (typically, DNA will be collected from extracted premolar).

Management Direction: Develop an Integrated Population Model (IPM) to aid in modeling of wolf population abundance and demographics.

Strategy: Incorporate data from camera-based abundance and occupancy estimates, documented mortality data, DNA-based estimates of litter and pack size, and radio collar data to model wolf populations, population dynamics, and the potential effects of different management actions on wolf populations.

Management Direction: Capture and radio-collar wolves as needed to support other methods of wolf population monitoring.

Strategy: Evaluate robustness of IPM relative to observed wolf population fluctuations, and radio-collar wolves if additional data is needed.

Management Direction: Prioritize research that improves wolf monitoring techniques.

Management Direction: Produce annual report summarizing wolf management and monitoring data and present to the Fish and Game Commission.

GOAL: Reduce wolf depredations on livestock.

Management Direction: Collaborate with the Idaho Wolf Depredation Control Board, USDA Wildlife Services, and livestock producers to reduce wolf depredations on livestock.

Strategy: Encourage livestock producers to report suspected wolf depredations promptly to facilitate rapid agency response and IDFG authorization of control actions.

Strategy: Continue to partner closely with USDA Wildlife Services to conduct investigations, confirm and document wolf-related losses.

Strategy: Continue to implement agency control actions in response to confirmed livestock depredations. Although the voluntary use of nonlethal deterrents may be advantageous to livestock producers in reducing wolf depredations and is encouraged, until the wolf population reaches the goal of fluctuating around 500 wolves, IDFG control authorizations in response to livestock losses will favor lethal removal. After the population reaches the goal, alternative nonlethal responses may be considered in some circumstances.

Strategy: Incentivize licensed hunters and trappers to focus harvest of wolves in areas with chronic depredation by supporting third-party agreements that reimburse expenditures related to their successful wolf hunting and trapping. Third-party reimbursements paid from IDFG funds would be limited to Game Management Units specified by IDFG and focused on units with chronic livestock depredations or units where ungulate populations are limited by predation and below Commission-adopted objectives.

Strategy: Provide long-duration and geographically broad agency control authorizations to conduct wolf removals to resolve or prevent livestock depredations in areas with a history of livestock losses or in other unsuitable habitat where depredations may occur. Authorizations would target removal of entire packs rather than individual wolves while the wolf population remains above the goal.

Strategy: Provide extended private kill authorization permits to livestock producers based on confirmed depredations. Authorizations would be valid on their own private land or public land grazing allotments while their livestock are legally present and would allow expanded methods of take (described in the Commission's current wolf seasons proclamation brochure). Other allowances or restrictions may be included on the individual permit. Authorizations may be scaled back after the wolf population reduction goal has been achieved.

Strategy: Support radio-collaring wolves to facilitate resolution of livestock losses in chronic depredation areas.

GOAL: Reduce wolf predation on ungulate populations that are not meeting management objectives.

Management Direction: Increase wolf mortality in areas where ungulate populations are not meeting objectives.

Managing the wolf population to fluctuate around 500 wolves is expected to reduce predation on wild ungulates in general. In areas where wolf predation continues to prevent ungulate populations from meeting management objectives, IDFG will focus additional efforts to reduce wolf predation.

Strategy: Incentivize licensed hunters and trappers to focus harvest of wolves in areas where ungulate populations are below objectives by supporting third-party agreements that reimburse expenditures related to their successful wolf harvest. Third-party reimbursements paid from IDFG funds would be limited to Game Management Units specified by IDFG and focused on units where ungulate populations are limited by predation and below Commission-adopted objectives or with chronic livestock depredations.

Strategy: Where harvest cannot reduce wolf impacts on ungulate populations, implement area-specific predation management plans and agency control actions that balance effectiveness with cost-efficiency.

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