GRAY WOLVES IN CALIFORNIA

AN EVALUATION OF HISTORICAL INFORMATION, CURRENT CONDITIONS, POTENTIAL NATURAL RECOLONIZATION AND MANAGEMENT IMPLICATIONS

California Department of Fish and Game

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Key Findings

- Although not well documented, wolves are considered to have been present historically in California, at least in the Sierra Nevada, southern Cascades, Modoc Plateau, and Klamath Mountains.

- Historic population information is unavailable. The paucity of documented, reliable observations, suggests that the population was not large.

- Gray wolves are expanding in the American west with substantial populations in Wyoming, Montana and Idaho, and smaller, reproducing populations in Washington and Oregon.

- Gray wolves are very mobile, wolf packs are dynamic entities and single wolves disperse over long distances. These factors create the potential that one or more gray wolves will disperse into California, most likely from Oregon.

- Where wolves have become reestablished, the level of public controversy has been significant.

- Under current regulations, any wolf in California is protected as endangered under the Federal Endangered Species Act. California has few laws mentioning wolves and has no legal mechanism to authorize depredation permits for the take of wolves.

- Wolves prey mainly on elk and deer. California elk populations are much smaller than States with current gray wolf populations, leaving mule deer as the most likely prey species for wolves in California.

- Livestock depredation by wolves generates significant public controversy. Available information based on documented wolf predation indicates that the overall economic effect is small and less than predation by coyotes, mountain lions or bears. However, the impact on livestock producers, particularly sheep producers, can be substantial.

- Gray wolves pose little direct risk to human beings.

- Several additional steps could and should be followed to prepare for the likely reoccurrence of gray wolves in California and possibility of a population.

I. Introduction

This document has several purposes, which are:

1. Provide a historic overview of gray wolves (*Canis lupus*) in California.
2. Consider current suitability of California as habitat for gray wolves.
3. Evaluate the potential for gray wolves to migrate to California, and should that occur, to become re-established as a resident species.
4. Consider legal and management implications of gray wolves in California.

This is not a plan to reintroduce wolves and there is no current information confirming the presence of wolves in California. However, given the proximity of recently established wolf populations in Idaho, Washington and Oregon, and the inherent ability of wolves to disperse over long distances, it is likely that wolves will naturally disperse to California.

This paper represents an understanding of the above topics by the California Department of Fish and Game (DFG) as of the cover date, As new information becomes available it will be used periodically to update this document.

2. Documented History of Wolves in California

2.1 Historic Occurrence and Distribution

Although gray wolves formerly inhabited California, their historic abundance and distribution is unclear (Schmidt 1991, Shelton and Weckerly 2007). While there are many anecdotal reports of wolves in California, specimens were rarely preserved. The historic range of the wolf in California has been reported to include the Sierra Nevada, southern Cascades, Modoc Plateau, Klamath Mountains, and perhaps the North Coast Ranges (Stephens 1906; Grinnell et al 1937; Hall 1981; Paquet and Carbyn 2003). However, Schmidt (1991) concluded that wolves also “probably occurred in the Central Valley, the western slope of the Sierra Nevada foothills and mountains, and the Coast Ranges of California until the early 1800s, although their population size is unknown and may have been small.“

2.2 Anecdotal Observations

Writings of early California explorers, settlers, and naturalists often refer to wolves. These descriptions were often accompanied by little detail and it is likely that many accounts are either erroneous or unfounded. Coyotes (*Canis latrans*) were often referred to as wolves or prairie wolves in California and other western

states in the late 1800s and early 1900s (Grinnell et al.1937, Bruff 1949), and coyotes in the Sierra Nevada, southern Cascades, and Klamath Mountains were frequently called gray wolves or timber wolves (Grinnell et al 1937)[1].

Based on available information, including known misidentifications, there is little credibility in many of these reports. An example of such an account is found in an 1827 journal entry describing life near the San Gabriel Mission (Los Angeles County): "Still at the Mission...Myself and Mr. McCoy went up into the mountains to see if we could find some dear [deer]; I saw two and wounded one, killed a wolf and two ducks..." (Rogers 1918). As no description of the wolf is presented, and no evidence from other parts of the journal indicated the author was familiar with coyotes, it is impossible to determine if the author was referring to *Canis lupus* or *Canis latrans*.

Dixon (1916) described fruitless efforts to obtain wolf specimens for the University of California:

> "For several years past the Museum of Vertebrate Zoology…has endeavored to corroborate reported occurrences of timber wolves in California, but without obtaining a single specimen. Several quite convincing reports of such captures have reached the Museum from time to time, but whenever the skin or skull was secured, the animal always proved to be a large mountain coyote…"

Except for the few cases where authors specifically mentioned both wolves and coyotes, or provided additional information suggesting their wolf observations were authentic, the anecdotal observations described in early writings must be treated with some skepticism. Additional anecdotal records are summarized and described in Appendix B.

2.3 Museum Specimens

DFG is aware of only two museum verifiable specimens of naturally-occurring wolves from California. Both are males located in the Museum of Vertebrate Zoology (MVZ) at University of California, Berkeley (Jurek 1994). One specimen was collected in the Providence Mountains, San Bernardino County, in 1922 (Johnson, et al 1948). It weighed roughly 100 pounds and apparently was caught in a steel trap, "while pursuing a bighorn sheep" (Grinnell et al 1937). Johnson et al (1948) noted that "This is the only record known to us of the occurrence of wolves in the Providence Mountain area, or, for that matter, anywhere in southeastern California. " Based on an examination of the skull, the authors concluded that this animal was more closely related to southwestern

[1] The coyotes inhabiting these montane habitats tend to be larger and have thicker fur than their lowland conspecifics, and some taxonomists have recognized this larger race as the mountain coyote (*Canis latrans lestes*).

subspecies than wolves from Oregon. Given taxonomy currently proposed by the U.S. Fish and Wildlife Service (USFWS) (2011c), this animal may have been a Mexican Wolf (*Canis baileyi*).

The other specimen was collected in 1924, near Litchfield, in Lassen County. It was fairly old, missing a portion of a hind leg, and was emaciated. Though it weighed only 56 pounds, it was estimated that in good condition it would have weighed approximately 85-90 pounds (Grinnell et al 1937).

In 1962 a wolf was killed near Woodlake in Tulare County. Since wolves had not been documented in California for nearly forty years, this incident generated considerable interest and speculation whether a small resident population still existed in California (Ingles 1965). This was an adult male weighing only fifty-six pounds. A study was conducted comparing the skull of this wolf to other specimens at the MVZ (McCullough, 1967). The researcher concluded that the available evidence suggest this animal was introduced into California and most closely resembles wolves found in Southeast Asia, particularly Korea.

Lastly, the Department is inquiring about a reported wolf specimen having been killed in 1959 in California near the town of Verdi, Nevada. As of this writing, there is no conclusive evidence on the species of animal taken.

2.4 Summary of California Distribution and Abundance

The available information suggests that wolves were distributed widely in California, particularly in the Klamath Mountains, Sierra Nevada, Modoc Plateau and Cascade Mountains. Most of the anecdotal observations are ambiguous as to whether the observer was reporting a wolf or a coyote and the physical specimens are very few in number. These facts are most consistent with a hypothesis that wolves were not abundant, even though they were widely distributed, in California.

3. Status of Gray Wolves in the United States

3.1 Historic Distribution Before 1995

Gray wolves have a circumpolar range and were at one time widespread in North America. Exceptions included habitat occupied by the eastern gray wolf, red wolf and Mexican wolf (Young and Goldman 1944; USFWS 2009a; USFWS 2011c). Wolves were historically present in California but their historic distribution and abundance in the state is uncertain (Shelton and Weckerly 2007). During the 19th century human population expansion and declines in prey availability resulted in declining wolf populations throughout much of North America (Young and Goldman 1944; Leopold et al 1981). By the mid-20th century, predator

control programs brought wolves to near extinction in the conterminous United States, except for northeastern Minnesota. Gray wolves remained widespread in Alaska and Canada.

Three wolf subspecies (i.e. Eastern Timber Wolf, *Canis lupus lycaon*; Northern Rocky Mountain Wolf, *Canis lupus irremotus*; and Red Wolf, *Canis rufus*) were listed as endangered in 1974 (USFWS 1974). At that time the only documented populations of reproducing wolves in the conterminous United States were in Minnesota and a small population in Isle Royale National Park (Michigan) in Lake Superior.

In the Great Lakes region, wolf numbers began to increase following Federal Endangered Species Act listing (i.e. 1974) in Minnesota and Wisconsin and in Michigan in about 1989 (USFWS 2007).

For 50 years prior to 1986, no gray wolf reproduction was documented in the northern Rocky Mountains although it is likely that gray wolves periodically crossed into northern Idaho and Montana from Canada. In 1986, a wolf den was discovered in Glacier National Park in northern Montana. That population steadily grew and by 1994, it included approximately 65 wolves throughout northwestern Montana (USFWS 1994b). Currently there are about 326 wolves in northwestern Montana (Sime et al 2011),

In southern Oregon, gray wolves are represented in museum collections from Josephine, Douglas, Lake, and Harney counties (Verts and Carraway 1998). Josephine and Lake Counties border California.

3.2 Gray Wolf Reestablishment in the Western United States

In 1980, the US Fish and Wildlife Service (USFWS) drafted the Northern Rocky Mountain (NRM) Wolf Recovery Plan to guide efforts to restore at least two populations of wolves in the lower 48 states (USFWS 1980). The plan was revised and approved in 1987 with the goal **"**to remove the Northern Rocky Mountain wolf from the endangered and threatened species list by securing and maintaining a minimum of ten breeding pairs of wolves in each of three recovery areas for a minimum of three successive years" (USFWS 1987). The recovery areas were identified as northwestern Montana, central Idaho, and the greater Yellowstone area. The plan recommended recovery through natural re-colonization primarily from Canadian populations. Reintroduction was recommended if natural re-colonization did not result in at least two breeding pairs within 5 years.

In 1991, Congress directed the USFWS to prepare a Draft Environmental Impact Statement for the purpose of reintroducing wolves to Yellowstone and Central Idaho. In 1994 the USFWS completed the FEIS and adopted a final rule to establish nonessential experimental populations of gray wolves in central Idaho

and Yellowstone National Park (USFWS 1994a; USFWS 1994b). Although the title of the final rule refers to central Idaho and southwestern Montana, the actual limits of the central Idaho and Yellowstone management areas included most of Idaho, more than half of Montana and all of Wyoming (USFWS 1994b). In 1995 and 1996, 66 gray wolves from Canada were introduced to Yellowstone National Park (31) and Central Idaho (35) (USFWS 2003). Intensive monitoring determined that by 2001, the minimum recovery goals of at least 300 wolves and 30 breeding pairs in Idaho, Montana and Wyoming were met. Wolf populations have exceeded the minimum recovery goals each year since (USFWS et al 2011a). In 2010, the NRM Distinct Population Segment (DPS) gray wolf population was estimated to contain at least 1651 wolves, in 244 packs and 111 breeding pairs (USFWS et al 2011a).

Following reintroduction of wolves into the NRM DPS, periodic confirmed sightings of wolves have been made in north-central Utah, although no packs have yet been documented. Transient individuals have been observed in Colorado, however, no packs have been documented (Colorado Division of Wildlife 2011). No wolf sightings have been confirmed in Nevada for several decades.

Wolf packs now occur in Oregon and Washington. The Imnaha pack in Oregon was confirmed by the Oregon Department of Fish and Wildlife (ODFW) in 2009, but was likely present in 2008 as the pack consisted of 5 adult-sized wolves when it was discovered (ODFW 2010(a)). As of August 2011, the Imnaha, Wenaha and Walla Walla packs are known to be present in Oregon (ODFW 2011). The Washington Department of Fish and Wildlife (WDFW) confirmed its first wolf pack in 2008 in Okanogan County (WDFW 2011a). As of July 2011, there are five confirmed wolf packs in Washington (WDFW 2011b).

3.3 Gray Wolf Endangered Species Act Chronology and Status in the Western United States

Three wolf subspecies (i.e. Eastern Timber Wolf, *Canis lupus lycaon*; Northern Rocky Mountain Wolf, *Canis lupus irremotus*; and Red Wolf, *Canis rufus*) were listed as endangered in 1974 (USFWS 1974) in the first list of species to be protected under the Endangered Species Act. At that time the only documented populations of reproducing wolves in the conterminous United States were in Minnesota and a small population in Isle Royale National Park (Michigan) in Lake Superior. Later, because the taxonomy of wolves was out of date and there were questions about exactly where the designation of endangered applied, the USFWS (1978) published a rule designating wolves at the species level (i.e. *Canis lupus*) as endangered in the conterminous states except in Minnesota where wolves were designated as Threatened.

In 2003, USFWS received a petition to delist the gray wolf in Nevada from the Nevada Department of Wildlife (NDOW). The petition provided a comprehensive

presentation of the historic range and occurrences of wolves in Nevada. The petition documented that wolves, whether in packs or solitary transient individuals, historically existed in Nevada. The petition indicated that the source areas of wolves that historically occurred in Nevada potentially included Idaho, northern California, and Oregon. In 2005, USFWS found that the petition was not warranted based on a review of available information (USFWS 2005). Although there is no current information to confirm the presence of wolves in Nevada, any wolf occurring in Nevada will be considered Endangered.

Between 2003 and 2010, the USFWS made multiple proposals to delist gray wolves in portions of the NRM DPS. Each effort was challenged successfully in Federal court and at the end of 2010 gray wolves in the NRM DPS remained listed as Endangered.

On April 15, 2011 President Obama signed Public Law 112-10 - The Department of Defense and Full-Year Continuing Appropriations Act, 2011. One section of the act required the Secretary of Interior to reissue the final rule previously published on April 2, 2009 delisting gray wolves in the NRM DPS, except in Wyoming. This became effective on May 5, 2011 (USFWS 2011b). As a result, wolves in Montana, Idaho, eastern Washington, eastern Oregon and Utah are delisted and now managed by the respective states. Two groups of plaintiffs filed suit challenging the constitutionality of this decision. On August 3, 2011 the United States District Court for the District of Montana filed an order to enter judgment in favor of the Federal government and against the plaintiffs. That decision has since been appealed to the U.S. Ninth Circuit Court of Appeals.

The USFWS is currently (USFWS 2011c) conducting a status review and soliciting information regarding distribution of gray wolves throughout the species range in the conterminous United States.

Any wolves that are present or may disperse into California are Endangered under the Federal Endangered Species Act. As of the date of this document, no gray wolves are known to be present in California.

4. Gray Wolf Ecology

4.1 Taxonomy

Gray wolves are the largest wild members of the dog family (Canidae) and include several taxa in North America. Gray wolves currently are established in the Western Great Lakes and NRM DPS's. Western Washington, western Oregon, and northern California are outside of the NRM DPS, but any wolves in these geographic areas are also classified as gray wolves.

The USFWS (2011c) is currently considering whether Mexican wolves in the American southwest should be classified as *Canis lupus baileyi* or as a DPS of *Canis lupus*. The USFWS is currently proposing that the eastern gray wolf be recognized as a full species, *Canis lycaon* (USFWS 2011c). Red wolves (*Canis rufus*) were originally widespread throughout the southeastern United States but were declared extinct in the wild in 1980. They have since been reintroduced in North Carolina.

Wolves are often confused with coyotes and domestic dogs (*Canis lupus familiaris*), and wolf hybrids, which result from the mating of a wolf and a domestic dog. The term "wolfdog" is used in this document to refer to these hybrid animals.

4.2 Physical Characteristics

Depending upon sex and geographic region, adult gray wolves range from 18-80 kg (40-175 lb) in weight (Mech 1974). Males are generally slightly heavier and larger than females, and vary in length from 1.3-1.6 m (4.2-5.4 ft). Shoulder height ranges from 66-81 cm (26-32 in) (Utah Division of Wildlife Resources 2005). Male wolves inhabiting the northern Rocky Mountains average over 100 lbs (45 kg), but may weigh up to 130 lbs (60 kg) (USFWS 2009a). Gray wolves generally weigh about twice as much as coyotes (Dixon 1916).

The fur of gray wolves is most often grizzled gray, but varies from white to coal black (Young and Goldman 1944). Additionally, wolf features are generally less "pointed" than those of coyotes; their ears are more rounded and their muzzles are broader (Young and Goldman 1944). Wolves can usually be distinguished from domestic dogs by their relatively longer legs, larger feet and narrower chest (Banfield 1974). In contrast to many domestic dogs, wolves have straight tails that do not curl up at the tip; a wolf carries its tail slightly below the level of the back though this varies when wolves are at play or frightened (Young and Goldman 1944).

4.3 Social Behavior and Reproduction

Wolves are social animals and normally live in packs of 2 to 12 animals but much larger packs sometimes occur (USFWS 2003). Pack size is largest in fall and early winter when pups are integrated into the pack. Reductions in pack size by late winter typically occur as a result of mortality and dispersal of younger animals (Paquet and Carbyn 2003).

Packs live within territories that they defend from other wolves. Territory sizes range from approximately 20 to 215 square miles, depending on available prey and seasonal prey movements. Wolf territories in the NRM DPS tend to be larger, however, and typically vary from 200-400 square miles (USFWS 2003).

Wolves communicate via posture, scents, and vocalizations. Wolves are believed to howl to reinforce social bonds within the pack, sound alarm, locate pack members, and warn other wolves to stay out of their territory (Paquet and Carbyn 2003). Wolves howl more frequently in the evening and early morning, especially during winter breeding and pup-rearing.

Wolf packs usually include a top-ranking ("alpha") pair, their offspring from the current year, and non-breeding adults (principally their offspring from previous years, but also sometimes non-related animals). Typically, only the alpha male and female in each pack breed and produce pups (Mech and Boitani 2003; USFWS 2003).

Females and males generally begin breeding as 2-year olds and packs typically produce one litter annually. The gestation period is 62-63 days. Most litters (1 to 11 pups) are born in early to mid-spring and average 5 pups. Pups are cared for by the entire pack, and on average four pups survive until winter (USFWS 2009a).

Birth usually takes place in a sheltered den, such as a hole, rock crevice, hollow log, or overturned stump. Young are blind and deaf at birth and weigh an average of 14.5 oz (450 g) (Utah Division of Wildlife Resources 2005). Pups generally emerge from dens at 3-4 weeks of age (Paquet and Carbyn 2003).

Pups depend on their mother's milk for the first month, but are gradually weaned and fed regurgitated meat brought by pack members. As pups age, they may leave dens but remain at "rendezvous sites", usually with an adult, while other adult pack members forage. Specific dens and rendezvous sites are sometimes used from year to year by a given pack (Paquet and Carbyn 2003). By seven to eight months-of-age, when they are almost fully grown, the pups begin traveling with the adults. After a year or two, wolves may disperse and try to find a mate and form a pack.

Pack social structure is generally adaptable and resilient. Breeding members can be quickly replaced from within or outside the pack, and pups can be reared by another pack member should they become orphaned. Consequently, wolf populations can recover rapidly following severe disruptions, such as high levels of human-caused mortality, or disease (USFWS 2009a).

4.4 Food Habits

Wolves travel over large areas to hunt, and may cover as much as 30 miles in a day. They generally prefer the easiest available travel routes (Paquet and Carbyn 2003) and often use semi-regular routes, sometimes referred to as "runways", through their territory (Young and Goldman 1944). Wolves primarily

prey on medium and large mammals, especially ungulates. In western North America (including Alaska), gray wolves are known to prey on whitetailed deer (*Odocoileus virginianus*), mule deer (*O. hemionus*), moose (*Alces alces*), elk (*Cervus canadensis*), caribou (*Rangifer tarandus*), bison (*Bison bison*), muskox (*Ovibos moschatus*), bighorn sheep (*Ovis canadensis*), Dall sheep (*O. dalli*), mountain goat (*Oreamnos americanus*), beaver (*Castor canadensis*), and snowshoe hare (*Lepus americanus*). Other mammals, birds, and large invertebrates are also sometimes taken (Paquet and Carbyn 2003).

In areas where wolves and livestock coexist, wolves kill livestock, including sheep, cattle, goats, horses, llamas, livestock guard dogs, and domestic pets.

4.5 Movements

Although some animals remain with their natal pack, yearling wolves frequently disperse and attempt to join other packs, establish new territories within occupied habitat, or form their own packs in unoccupied habitat (Mech and Boitani 2003). Although the average dispersing distance of NRM wolves is about 60 miles, some animals disperse very long distances. Individual wolves can disperse over 680 miles from their natal pack, with actual travel distances, documented through global positioning system technology, exceeding 6,000 miles (USFWS et al 2011a). In recent years, dispersing wolves have established packs within Washington and Oregon. California is well within documented dispersal distances from extant wolves in Oregon, Washington, and Idaho.

4.6 Mortality

Wolves may live up to 13 years in the wild (Mech 1988). In the NRM DPS, however, the average lifespan is less than four years (USFWS 2009a). Causes of mortality for gray wolves include starvation, disease, intraspecific aggression, interspecific conflicts, accidents, and human-related events (e.g., legal and illegal harvest, collisions with vehicles) (Paquet and Carbyn 2003).

The USFWS et al (2011a) summarized the most recent information on wolf mortality from the NRM DPS. "In 2010 all documented human-caused mortality (agency authorized control, hunting, and other human-caused) removed 179 wolves in MT, 142 in ID, and 56 in WY. This meant that 24% of the estimated minimum wolf populations in MT, 17% in ID, and 13% in WY were known to be killed by people in 2010. In addition, past research on radio-collared NRM DPS wolves from 1984-2004 (Murray et al 2010; Smith et al 2010) indicated roughly 26% of adult-sized wolves died annually (80% of all mortality was caused by humans) and the population still grew >20% annually."

4.7 Habitat Requirements

Wolves are habitat generalists and historically occupied diverse habitats in North America, including tundra, forests, grasslands, and deserts. Their primary habitat requirements are the presence of adequate ungulate prey, and water. As summarized by Paquet and Carbyn (2003), habitat use is strongly affected by the availability and abundance of prey, availability of den sites, ease of travel, snow conditions, availability of protected public lands, density of livestock, road density, human presence, and topography.

Suitable habitat generally consists of areas with adequate prey where the likelihood of human contact is relatively low (Mladenoff et al 1999). Large undeveloped tracts of public land often provide suitable habitat and are generally required for the persistence of regional wolf populations in North America (Paquet and Carbyn 2003). The primary role of wild lands in benefiting wolves appears to be that they reduce human access and, thus, provide indirect protection for wolves (Mech 1995). However, gray wolves continue to expand their range in the U.S., and some wolves live proximate to substantial human development. Haight et al (1988) concluded that wolves can likely survive in such areas, as long as disjunct populations are linked by dispersal, prey is abundant, and human persecution is not severe.

5. Gray Wolf Potential Habitat and Dispersal in California

5.1 Habitat Suitability Modeling

This section reviews information for gray wolves in other states and considers the availability of potentially suitable habitat in California.

Assessing wolf habitat in Wisconsin, Mladenoff et al (1995) found that agricultural lands, small-parcel private ownership, road density, and human population density were negatively related to existing wolf pack territories. Forests with a conifer (evergreen) component, and county-managed forest lands were positively related to wolf pack locations. More recent modeling efforts have suggested the best predictors of wolf habitat in the Great Lakes region appear to be lack of agricultural land and low road density (Mladenoff et al 2009).

In the northern Rocky Mountains increased forest cover, lower human population density, higher elk density, and lower sheep density are the primary factors related to occupied vs. non-occupied areas (Oakleaf et al 2006). Another model for the northern Rocky Mountains found road density and land cover to be the most influential landscape variables for determining habitat suitability; wolves

tended to use coniferous forests on public lands with low road density (Houts 2002).

Larsen and Ripple (2006) modeled gray wolf habitat suitability (those areas calculated to have “>50% wolf pack probability”) in Oregon and several adjacent states. The model incorporated values for forest cover and public lands. It predicted substantial amounts of probable wolf habitat in Oregon, including most of the Cascade Mountains, portions of northeastern Oregon (e.g., the Wallowa, Blue, and Ochoco ranges and adjacent lands), and much of the Siskiyou/Klamath area. Areas of probable wolf habitat in the Cascades and Siskiyou/Klamath area are adjacent to California's Del Norte, Siskiyou, and Modoc counties. Larsen and Ripple (2006) also estimated that Oregon could support approximately 1,450 wolves, including 600 in the Cascades and 120 wolves in the Siskiyou/Klamath region (18 wolves/1000 km^2 in both areas).

Carroll et al (2001) developed a model for Oregon and California that included estimated prey density, prey accessibility (a function of slope, where increasing ruggedness makes prey less accessible), and security from human disturbances (a composite of road and human population density). The authors also estimated the number of wolves that might occupy a given area. Their model predicted the southern Cascades/Modoc Plateau region of southern Oregon and northern California would likely provide the largest, essentially contiguous area of suitable habitat in the study area. The authors estimated the area might support 190-470 wolves. Other areas modeled as suitable habitat in California included the Sierra Nevada and parts of the southern Klamath and North Coast ranges. The authors noted that wolves are generally constrained by topography, and this constraint may limit habitat suitability in steep, rugged areas such as those found in much of the Klamath Mountains and southern Sierra Nevada.

Carroll et al (2006) used a spatially-explicit population model as a tool for addressing appropriate recovery goals and strategies for the gray wolf in the western U.S. That model linked estimates of survival and fecundity for individual animals and GIS data on mortality risk and habitat productivity to predict “occupiable habitat” (i.e., areas most likely to provide long-term viability for wolves). The authors also modeled potential future occupied habitat under different human population and land management scenarios. C. Carroll, the senior author of the 2001 and 2006 publications, believes the 2006 model substantially improved on the 2001 model (personal communication, C. Carroll).

The 2006 model predicts that if current habitat trends continue, the central and southern Sierra Nevada would provide the largest area for a potential wolf population in California. Other areas of potentially suitable habitat include California's southern Cascades, the Modoc Plateau (in the approximate vicinity of Mt. Shasta, the Medicine Lake highlands, the Devil's Garden, and the Warner Mountains), and the Klamath Mountains (in the approximate vicinity of the Trinity Alps Wilderness). Compared to many areas in California, these areas have low

human population density, have few year-round or heavily traveled roads, and are predominantly public land.

5.2 Potential Gray Wolf Dispersal to California

Since the mid-1990s, gray wolves have greatly expanded their range in the northern Rocky Mountains and Pacific Northwest. In 2010, Montana had 118 wolf packs, Idaho had 87 and Wyoming had 45 (USFWS et al 2011a). Individual wolves have dispersed to Utah and Colorado. Several additional packs are now established in Washington (WDFW 2010) and northeastern Oregon (ODFW 2010).

Currently, Nevada is not known to support gray wolves although they were present in the past (USFWS 2005). Therefore Nevada is not likely to be a source of wolves that may disperse into California in the near future.

It is likely that wolves will continue to expand within Oregon and that these changes in numbers and distribution will be tracked by ODFW. Patches of suitable habitat are available throughout much of northeastern Oregon, and larger areas of habitat are present in the Cascades and southwestern part of the state (Carroll et al 2006; Larsen and Ripple 2006). Dispersing wolves can travel great distances and can readily traverse most habitat types. Wolves in Oregon are protected by the state's endangered species act and the state has adopted the "Oregon Wolf Conservation and Management Plan" (2010) Assuming current management practices are followed in the future it is likely that wolves will persist in Oregon and are likely to disperse into California.

It is possible that wolf packs could slowly colonize portions of central and western Oregon before moving into California. Monitoring of pack movements would give a better indication of potential entry into California. Based on the current distribution of wolves and the predicted distribution of suitable habitat in the state, it is most likely that dispersing wolves will first arrive and reside in Modoc or Siskiyou counties. However, any future pattern of habitation in the state is unknown.

6. Implications of Gray Wolf Recolonization in California

6.1 Legal Considerations

6.1.1 Federal Law

California is outside the NRM DPS and any wolves dispersing into California will be considered endangered pursuant to the Endangered Species Act (USFWS 2009a).

6.1.2 California Law

The California Fish and Game Code (FGC) and Title 14 of the California Code of Regulation (CCR) include several statutes and regulations germane to wolves, if they return to the State. These include:

FGC §2150 Provides methods which authorize possession of wild animals by permit.

FGC §2157 (a) "Every person holding a permit issued pursuant to §2150 shall uniquely identify each wild mammal that poses a risk to the health and safety of the public and report this identification to the department to maintain in a registry. (b) The commission shall adopt regulations that address the following: (1) Identify the mammals that pose a risk to the health and safety of the public and are subject to subdivision (a). This identification shall include the following species of mammals: wild cats, elephants, nonhuman primates, bears, and **wolves**."

FGC §4150 and **§4152** "All mammals occurring naturally in California which are not game mammals, fully protected mammals, or fur-bearing mammals, are nongame mammals." These sections include general prohibitions on take of nongame animals. However, nongame animals may be taken when damaging crops or property

Penal Code §653 (o) "It is unlawful to import into this state for commercial purposes, to possess with intent to sell, or to sell within the state, the dead body, or any part or product thereof, of any polar bear, leopard, ocelot, tiger, cheetah, jaguar, sable antelope, **wolf** (Canis lupus), zebra, whale, cobra, python, sea turtle, colobus monkey, kangaroo, vicuna, sea otter, free-roaming feral horse, dolphin or porpoise (Delphinidae), Spanish lynx, or elephant."

14 CCR §670 (c) (2) (K) identifies **wolves** as a "restricted species" subject to permits for possession

6.2 Livestock Interactions

Predation on livestock by wildlife is a concern for ranchers and farmers throughout the United States. It is reasonable to expect several outcomes if wolves become established in California. First, wolves will kill some livestock. Second, for at least the first several years after wolf recolonization, the level of livestock predation will be low, probably less than that observed to date in Oregon. Third, livestock losses from wolf predation will likely be less than 1% of the amount of predation currently experienced from coyotes, mountain lions and bears combined, and negligible compared to other sources of mortality.

6.3 Ungulate Interactions

Ungulates are mammals with hooves, and are favored prey for wolves. In the NRM DPS, elk, mule deer and white-tailed deer are the favored ungulate prey species. Moose and bison are also taken regularly. Pronghorn antelope are taken infrequently (Idaho Wolf Legislative Oversight Committee 2002; Jimenez et al 2011; ODFW 2010a).

In the NRM DPS, the effect of wolf predation on ungulates has been variable. In the Lolo Elk Zone wolf predation substantially affected elk populations. In other areas the effect has not been measurable (Idaho Department of Fish and Game 2008). In the Yellowstone ecosystem, researchers documented substantial behavioral effects on elk from wolf reintroduction. Elk spent more time in forested areas, on steeper slopes and at higher elevations (Creel et al 2005; Mao et al 2005).

Prey availability is an important factor affecting wolf distribution and abundance. In California, the most abundant ungulate is mule deer (including black-tailed deer). The following table compares deer and elk populations in California with Oregon, Idaho and Montana as an index of the potential food resource which could be available to wolves. A caveat is that estimates of ungulate populations are not precise for any moment in time, they can fluctuate substantially from year to year and the animals are not distributed evenly across the landscape. California has more deer than Oregon, and fewer deer than Idaho or Montana. It's notable that while elk are expanding their distribution and abundance in California, there are large areas where they are not present. Elk populations in Oregon, Idaho and Montana are much larger than that in California, roughly ten times greater than the California population in each of these states. While California has substantial habitat with physical attributes suitable for wolves it is not clear that prey populations, particularly elk, will support as many wolves as Idaho or Montana.

Species	California	Oregon	Idaho	Montana
Mule Deer	455,000	216,000	300,000	281,000
White-tailed Deer	0	6,400	200,000	249,000
Total Deer	455,000	222,400	500,000	530,000
Elk	12,000	121,000	125,000	118,000
Data Source	DFG unpublished information	ODFW 2010	Zager et al 2007; Rachael, 2011	Montana Fish, Wildlife and Parks, 2010

6.4 Interactions with Other Wildlife Species

Top predators such as wolves have the ability to tremendously alter the structure of the communities in which they live. Wolves are an apex predator in a complex food web which they substantially alter when they are removed or reappear. For example, extirpation of wolves likely resulted in increased populations of coyotes (Berger and Gese 2008). Increased coyote populations subsequently led to declines in pronghorn (Berger and Gese 2008) and swift fox (Kitchen et al 1999). Perrine (2005) noted concern over interspecific competition among coyotes and Sierra Nevada red fox. The reemergence of wolves may result in positive trends for some species that are preyed upon by coyotes.

Competitive interactions also may occur between wolves and other large predators. Wolves interfere with the foraging success of mountain lions and may reduce the carrying capacity for lions (Kunkel et al 1999). In addition, mountain lions avoid areas occupied by wolves and are sometimes killed by wolves (Kortello et al 2007).

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).

6.5 Human Interactions

Few wildlife species elicit the kind of response from humans that wolves do. Wolf recovery in the NRM DPS, for example has been very controversial (Herring, 2011). It is reasonable to predict that if wolves make their way to California, it will also be controversial.

Beginning in 1915, the federal government was involved in trapping programs that reduced or eliminated wolf populations (Leopold 1933). As the west was being settled, wolves and other large predators were targeted for removal to protect livestock brought with the settlers and to reduce competition with human hunters (USFWS 1994a). A common species in the Rocky Mountain states in the late 1800s, wolves became rare or were extirpated by the early 1900s.

Complicating the issue of wolf predation, and to some extent perceptions about human safety, is the issue of wolfdogs and the ability to distinguish actions of

wolves from those of wolfdogs. Wolfdogs are sold commercially in California[2] and elsewhere. Reports have been received of encounters with these animals in the wild in California including animals on or off leashes, or abandoned and free-roaming (Chris Brennan pers. comm. 2011). Some humans may even release wolfdogs into the wild in a misguided attempt to reestablish wolves to their historic range (Ed Bangs pers. comm. 2010).

Reports from USDA/APHIS Wildlife Services (Chris Brennan pers. comm. 2011) in northern coastal California indicate that incidents involving wolfdogs increased dramatically in the early 2000s, with numerous animals taken as a result of livestock damage. It was reported that these animals appeared to be, or allegedly were malamute-wolf or pit bull-wolf crosses, could roam 10-15 miles in a day, and were inefficient predators. These hybrids were, however, easily removed by livestock owners or USDA/APHIS Wildlife Services personnel.

Documented attacks on humans by wolves in North America are very uncommon despite the presence of 52,000-60,000 wolves in Canada, 7,000 – 10,000 wolves in Alaska and over 3,000 in the conterminous United States (McNay 2002a, 2002b, Linnell, et al, 2002). However, such attacks have occurred. Though some attacks were from animals that were rabid or hybrid wolfdogs, some were by apparently healthy wild animals. An overview and review of 80 specific instances in Alaska and Canada is provided in McNay (2002a, 2002b).

Instances of wolves killing humans are extremely rare. There have been two recent instances in North America where attacks, allegedly by wolves, resulted in human death. On November 8, 2005, a 22 year old man in northern Saskatchewan was killed while walking in the woods, either by gray wolves or by a black bear. The official investigation was equivocal whether gray wolves or bears were responsible. Both black bears and wolves regularly scavenged at a nearby garbage dump and were reported to be habituated to humans.

On March 8, 2010 a 32 year old woman in Chignik Lake, Alaska was attacked and killed while jogging along a road. An exhaustive investigation by the Alaska Department of Fish and Game (Butler et al., 2011) concluded that wolves were responsible for this fatality. .

[2] It is legal to possess second generation ("no state permit is required to possess the progeny of F1 generation wolf hybrids", per §671(c), Title 14, California Code of Regulations) wolfdogs in California.

6.6. Economic Implications

When elk, moose and some deer populations have declined and state wildlife agencies have made appropriate reductions in tags, there has been an economic and recreational impact on guides and outfitters, hunters, and local communities. Reductions in hunter opportunity result in fewer dollars spent in local communities (Loft 1998), and can result in smaller budgets to state wildlife agencies. As tag numbers and hunts are decreased or even completely eliminated, businesses dependent upon hunter dollars contract or cease to operate. In the year 2000, over 2,800 antlerless elk permits were available to hunters in the northern Yellowstone herd. Only 100 antlerless permits were available to hunters in 2006 as managers responded to declining calf recruitment and population declines. Such declines in hunter opportunity result in fewer dollars expended in local communities (Loft 1998), opposition to future wolf conservation and management proposals and reduced income for state wildlife agencies for resource management.

The final Environmental Impact Statement prepared for wolf reintroduction in the NRM DPS by USFWS predicted that tourism in Montana and Idaho would increase with a recovered wolf population, and that monies spent by visitors would exceed lost revenue due to livestock predation and decreases in hunter-generated revenue (USFWS 1994a). Prior to wolf reintroductions, a 1991 survey of visitors to Yellowstone National Park estimated that $19 million would be contributed to the three-state region of the Greater Yellowstone Area (GYA) should wolves be recovered there. Based on Duffield's (2008) recent survey, visitors from outside the three-state region who are coming specifically to see or hear wolves spent an estimated $35.5 million in 2005.

7. Current and Potential Actions by California Department of Fish and Game

Current Actions

- Develop coordination strategy with Fish and Wildlife Service and US Department of Agriculture, Wildlife Services for managing wolves in California
- Clarify roles and responsibilities for future actions by DFG, particularly the Wildlife Branch and Northern Region.
- Meet with Oregon Department of Fish and Wildlife to discuss their process for developing a wolf management plan and subsequent experiences managing the species.
- Direct wildlife biologists to meet with counterparts in Oregon and Idaho to train on field methods for monitoring gray wolves and evaluating reported wolf predation.
- Develop and implement public outreach/information plan

- Brief the Fish and Game Commission.
- Include narrative where appropriate for gray wolf within revision to the Statewide Wildlife Action Plan.
- Develop coordination and monitoring plan with public land managers, USDA/APHIS Wildlife Services and USFWS on wolf sightings. Define roles and responsibilities.
- Develop response guidelines regarding sightings, depredation, and public safety. Define roles and responsibilities.
- Meet with livestock producers (Cattlemen Association, California Wool Growers, Farm Bureau), hunting and environmental organizations regarding consequences of wolf dispersal in California.

Potential Future Actions

- Develop a refined habitat suitability model for gray wolves in California.
- Modify the Fish and Game Code or California Code of Regulations Title 14 to provide specific status/protection/management language for wolves.
- Drawing from experiences in Oregon and Washington, develop a wolf conservation or management plan that could be implemented if wolves become established in California, and identify the steps necessary to do so.
- Initiate funding proposals to support the above efforts.

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APPENDIX B. Anecdotal Sightings and Observations

Central Valley and coastal central and southern California. Several references to wolves are recorded from coastal California and the Central Valley prior to 1850. As noted by Schmidt (1991), references to wolves from these more heavily settled and agricultural areas generally ceased prior to the Gold Rush. Subsequent sightings occurred in more remote, montane locations.

In 1769, Pedro Fages, a Spanish soldier documenting travels between San Diego and San Francisco, made several references to wolves, coyotes, and foxes in his descriptions of wildlife found along his route (including several descriptions of all three in a particular region, such as the area between modern Irvine and Ventura, as well as the vicinity of San Francisco Bay). His original journals have been translated and published (Fages, 1937)

In the vicinity of San Francisco and Monterey during 1826-27, Beechey (Beechey et. al. 1941) noted "wolves and foxes are numerous, and the cuiotas, or jackalls, range about the plains at night, and prove very destructive to the sheep."

In 1841, separate parties of the U.S. Exploring Expedition reportedly observed wolves in the Sacramento River valley (Beidleman 2006). Fremont (1887) mentioned two wolf sightings in the Central Valley in 1844. A member of his party encountered two wolves in the Sacramento Valley in March, and on April 7 Fremont reported seeing "wolves frequently during the day – prowling about for the young antelope, which cannot run very fast."

Sierra Nevada, southern Cascades, and Klamath Ranges. J. Goldsborough Bruff, a gold seeker, traveled to California and spent the fall and winter of 1849-1850 near Barkley Mountain, between Mill and Deer creeks (eastern Tehama County). Bruff kept an extensive journal (Bruff, 1949), and frequently mentioned wolves during his trip across the plains and during his time in the southern Cascades. While passing through the vicinity of the Pit River, Bruff mentioned passing the carcass of a dead wolf and observing wolf tracks. Near his fall camp he described killing a "very large yellow wolf", and at his winter cabin he noted "wolves are very numerous here...the largest gray wolf is often a very big fellow." At his cabin he also once observed "an immense gray wolf, - the largest I ever saw, and larger than I thought that animal ever grew...seemed to stand 4 feet high, was very dark gray on the back, some white about his breast cheeks and face, and left the print of his feet, as large as those of a large panther; 4½ inches across" (Bruff 1949). Although some of his numerous descriptions of wolves appear to have possibly been coyotes, Bruff was apparently familiar with both animals. His journal contains a summary chapter on the fauna he encountered during his travels, and in it he describes six types of wolves (named primarily by

color and size), as well as the “prairie wolf (*Canis latrans*)” and “the coyote, of the valleys of California.”

Several explorers reported wolf encounters while passing through north-central California. In 1851, Newberry (1857) reported the “large gray wolf” as being much less common than the coyote, yet still occurring in “all the uninhabited parts of California and Oregon.” Based on the coloration of wolves and wolf skins seen by his party, Newberry also stated “it is probable that the white and black varieties are never found in California.” Also in 1851, George Gibbs reported observing a “black wolf” in the mountains between the Scott and Shasta valleys (Suckley and Gibbs 1860). Gibbs was clearly familiar with coyotes, as he also reported seeing them in great numbers in nearby Scott Valley and also killing one in the Eel River drainage. In May 1860, John Keast Lord (1866) camped overnight on a tributary of the Upper Sacramento River in Shasta County. He reported hearing wolves “barking and howling all night” and driving them from his camp with a “fire-log”. The following morning he noted encountering a mule at a nearby packers' camp that had been killed by the wolves. Lord also was apparently familiar with coyotes, as elsewhere in his writings he specifically referred to Indian dogs in the Columbia River as “prick-eared curs, simply tamed prairie-wolves.” In the Sierra Nevada in 1863, William Brewer (Brewer, 2003) observed a “large wolf” near Tuolumne Meadows and also met two men who had wintered at Hermit Valley (elevation 7000') and “killed several rare animals – two gluttons [wolverines], stone martens, silver-gray foxes (so rare their skins are worth fifty dollars each), large gray wolf, etc..” Brewer too was familiar with coyotes, and in some cases he seemed to use the terms interchangeably.

Summarizing his efforts to collect mammals in the northern Sierra and also providing a list of other common animals and those known to trappers, Price (1894) noted that gray wolves “have been seen several times by Mr. Dent in the dense forests above 6000 feet.” Price also described coyotes as common on both sides of the Sierra and reported they could be found in summer following sheep up to the highest meadows.

Aside from the museum specimens described in Section 2.3, the most recent credible accounts of wolves are from Modoc County. According to interviews conducted in the 1920s with a Fish and Game Deputy from Alturas and a Forest Ranger, two wolves were trapped in the vicinity of Alturas in 1911 and one was trapped in 1912 (Grinnell et al. 1937). Four wolves were trapped in 1922 near Tionesta (Grinnell et al. 1937).

Charles Poole was the California state lead for Predatory Animal Control with the U.S. Biological Survey (Poole 1933). In a 1939 letter to the Fish and Wildlife Service, Mr. Poole mentioned that a wolf was taken in Modoc County in July 1922. Poole described it as “a drift from Oregon” (Young and Goldman 1944). It is possible this wolf was one of the animals mentioned by Grinnell et al. (1937)

as being taken in 1922 near Tionesta. Poole also described “the last authentic case of timber wolves” in California as occurring near Cow Head Lake (northeast of Fort Bidwell and very close to the Nevada and Oregon borders). Poole “determined beyond doubt that there were 5 [wolves] present; but within a very short time after my investigation, they disappeared and have never been heard of since. Without doubt they went into Oregon…” Although Poole apparently did not provide a date for this observation, it must have occurred sometime between 1922 and 1939.

Studies of Native Americans in northernmost California also suggest wolves probably occurred in the southern Cascades. Summarizing the food preparation of American Indians near Lassen Peak, Schulz reported that some groups consumed wolf and fox flesh, while others shunned coyote and dog (Schulz 1988). Newberry (1857) implied observing Indians with wolf skins in California. Shasta Indians reportedly traded wolf skins to the Karuk tribe (Davis 1963). Further west, wolves figured in Yurok mythology (Kroeber 1976), and Yuroks were in possession of wolf headdresses (Anonymous 2010).