Lee, Rhianna@Wildlife

Subject: FW: Gray Wolf Petition (California Endangered Species Act) - Status Review for California
Attachments: R.Baldwin review.docx

From: Roger A Baldwin [mailto:rabaldwin@ucanr.edu]
Sent: Friday, November 22, 2013 4:24 PM
To: Loft, Eric@Wildlife
Subject: RE: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Eric,

Attached, please find my solicited review. Let me know if you have any questions or comments.

Roger A. Baldwin, Ph.D.
Wildlife Specialist
Department of Wildlife, Fish, and Conservation Biology
One Shields Ave.
University of California, Davis
Davis, CA 95616
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E-mail: rabaldwin@ucdavis.edu

From: Loft, Eric@Wildlife [Eric.Loft@wildlife.ca.gov]
Sent: Thursday, November 21, 2013 10:42 AM
To: Roger A Baldwin
Subject: RE: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Hello—I realize how busy you must be, but I wanted to send a reminder that we would appreciate any review by tomorrow Nov 22. We will understand if your schedule does not allow time for this effort. Thanks in advance for your consideration-- Eric

---

From: Loft, Eric@Wildlife
Sent: Friday, October 18, 2013 12:07 PM
To: 'Roger A Baldwin'
Subject: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Dear Dr. Baldwin,

Thanks for your tentative agreement to review the subject document attached here (WORD document plus PDF of appendix/figures). Please review the attached letter (PDF) describing our intent, purpose, and request of you as a reviewer. I understand that plans may change and you may not be able to review the document for us. If that is the case please let me know as soon as practical. Otherwise, thank you very much in advance for your expertise and insight regarding the document.

Please contact me by email or telephone if you have any questions/concerns about this effort.

Sincerely,

Eric

Eric R. Loft, Ph.D, Chief
Wildlife Branch
California Department of Fish and Wildlife
1812 Ninth Street, Sacramento, CA 95811
(916) 445-3555; eric.loft@wildlife.ca.gov
Web: www.wildlife.ca.gov

From: Roger A Baldwin [mailto:rabaldwin@ucanr.edu]
Sent: Thursday, September 26, 2013 2:25 PM
To: Loft, Eric@Wildlife
Subject: RE: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Eric,

Yes, I too will provide a tentative "yes" to provide the requested review.

Roger A. Baldwin, Ph.D.
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Phone: 530-752-4551
E-mail: rabaldwin@ucdavis.edu

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DEPARTMENT OF WILDLIFE, FISH & CONSERVATION BIOLOGY
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Dr. Eric Loft:

Thank you for the opportunity to review the status report for the gray wolf. This is a species that, if present in California, will likely result in substantial human-wildlife conflict. As such, I am glad my thoughts were included in the review. That being said, although I do have fairly extensive experience with a variety of carnivore species, I would not consider myself a wolf expert. Therefore, I will focus most of my review on general ecological concepts, wildlife management practices, habitat assessments, and human-wolf conflict issues. I know you have ample wolf expertise on the review panel to address any potential concerns with general wolf biology/ecology questions.

I found the report to be thorough. I am sure it was challenging to put together given that there is almost no data available on wolf ecology or management in California. I believe the scientific data that is included appears to be sound. Based on this report, I believe there are four primary areas to focus on with respect to whether or not to list the wolf as a California endangered species. The first item does not pertain to the population and life history categories of CESA, but I think it is worth mentioning nonetheless. The last three do pertain to these categories, so perhaps they will be of greater interest to you.

1) Wolves do not currently populate the state. I realize that this does not preclude listing, but it seems to me that limited funds would be far better served protecting other species that need much more immediate protection.
2) The subspecies of wolf that will likely repopulate appears to be different than the subspecies of wolf/wolves that was/were historically present in the state. This poses both ethical and practical concerns. First off, do we wish to protect a subspecies that is not native to the state? I realize this is a topic that could be, and has been, debated ad nauseum, but I think it is worth mentioning at least. Secondly, and perhaps more relevant for this review, how does the size of this different subspecies impact the ability of the landscape to support these wolves given that *Canis lupis occidentalis* (the likely populating subspecies) is larger than *Canis lupis nubilis* (the purported native subspecies)? As the report clearly states, there is already some concern whether or not there is a large enough prey base to support wolves. Having a historically larger subspecies present in the state would put added pressure on this prey base to support these wolves. This could lead to a reduction in population size of select prey species, may result in increased livestock predation, etc. In short, I believe this is a very important consideration.
3) Wolves are highly adaptable and efficient predators; there is little doubt that they could exist at some level in California. However, what is less clear is the impact they might have on prey populations in the state. It is certainly plausible that wolf presence could substantially lower carrying capacity of many areas for these prey species. As already mentioned, a shrinking prey base could lead to greater predation of livestock and other domestic animals as well. This needs

to be considered and planned for going forward.

4) What is suitable habitat for wolves in California is clearly a topic that will require some debate. A best guess is all that is possible at this time, and one guess could be substantially different from another depending on the model components. This makes it more difficult to accurately develop a recovery plan for wolves should they be listed before repopulating the state. This uncertainty could be provided as a reason not to list wolves at this time.

These are my primary comments as they pertain to this report. However, I do have some secondary thoughts as well. They are as follows:

1) In the Management Recommendations section of the report, the authors indicate that management strategies will need to be developed to deal with wolf-livestock conflict. I am obviously biased on this topic, but I feel much attention should be focused on this issue. This is one area where I do think substantial planning would be beneficial. I believe we all agree that it is highly likely that wolves will eventually find their way into California. When this happens, there will almost certainly be livestock depredation events that occur. Whether or not wolves are listed as an endangered species in California, protocols will need to be in place to address these human-wolf conflict situations. Having this hashed out ahead of time will help to defuse some of the tempers that are likely to flare during livestock depredation events, and may result in greater acceptance of wolves back into California ecosystems.
2) For what it is worth, I agree that the primary threats that will face wolves as they re-enter the state are managing human-wolf conflict, and the availability of suitable prey and habitat. That being said, I do not believe based on the data currently available (as synthesized by this report) that wolves will have a problem surviving, and perhaps thriving, in this state. Rather, the bigger question will likely be what impact wolves have on the local ecosystems, as well as their impact on humans, both from a social welfare and economic perspective.
3) Lastly, an editorial comment. On page 4, line 18, do the weights reference Montana wolves or Washington wolves? Montana is listed, but the source is Washington.

Once again, thanks for the opportunity to assist in the review of the status of wolves in California. If you have any questions about my review, please feel free to ask.

Respectfully,

Roger A. Baldwin, Ph.D.

Roger Baldwin

Wildlife Specialist
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Lee, Rhianna@Wildlife

Subject: FW: Gray Wolf Petition (California Endangered Species Act) - Status Review for California
Attachments: Gray Wolf 2013 Status Review for Peer Review Bangs.doc

From: Ed Bangs [mailto:edward100@bresnan.net]
Sent: Wednesday, October 23, 2013 1:53 PM
To: Loft, Eric@Wildlife
Subject: Re: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

My review attached. It is very good. Few comments but nothing major. Good luck. ed

On Fri, 18 Oct 2013 19:09:18 +0000
"Loft, Eric@Wildlife" <Eric.Loft@wildlife.ca.gov> wrote:
> Dear Mr. Bangs,
>
> Thanks for your tentative agreement to review the subject document
>attached here (WORD document plus PDF of appendix/figures). Please
>review the attached letter (PDF) describing our intent, purpose, and
>request of you as a reviewer. I understand that plans may change and
>you may not be able to review the document for us. If that is the case
>please let me know as soon as practical. Otherwise, thank you very much
>in advance for your expertise and insight regarding the document.
>
> Please contact me by email or telephone if you have any
>questions/concerns about this effort.
>
> Sincerely,
>
> Eric
>
> Eric R. Loft, Ph.D, Chief
> Wildlife Branch
> California Department of Fish and Wildlife
> 1812 Ninth Street, Sacramento, CA 95811
> (916) 445-3555;
> eric.loft@wildlife.ca.gov<mailto:eric.loft@wildlife.ca.gov>
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>
>From: Ed Bangs [mailto:edward100@bresnan.net]
> Sent: Thursday, September 26, 2013 11:36 AM
> To: Loft, Eric@Wildlife
> Cc: rwayne@ucla.edu<mailto:rwayne@ucla.edu>;
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>npwrc@usgs.gov<mailto:npwrc@usgs.gov>;
>carlos@klamathconservation.org<mailto:carlos@klamathconservation.org>;
>Loft, Eric@Wildlife
> Subject: Re: Gray Wolf Petition (California Endangered Species Act) -
>Status Review for California
>
> Eric, a tentative yes, from the only non-Dr. I'd be glad to review
>and provide comment. I assume the document would also discuss the CA
>law and what any listing means. Just wondering about the legal
>implications and policy background per listing under state law and how
>any science fits into that decision process.
>
> Sent from my iPad
>

Summary of Ed Bangs comments 10/23/2013

I found this to be an excellent science-based overview and it covered all the important points related to wolf biology and conservation. It might have used a few more literature cites here and there but generally they would have added nothing to the overall science being used and referenced or the conclusions reached.

I would caution that theory about wolf taxonomy has been changing rapidly every time a new technique, investigator, or approach comes along- for the past 30 years. I suspect that dynamic will not change in the near future. Seems like the various bureaucratic processes take 2-3 years to complete and taxonomic theory changes every 1-2 years so I would stay away from it as much as you can and be sure to qualify your analysis of the state of it as current literature suggests or some other wording. That being said your write up was very good.

The habitat model seemed as good as you could do, but from it I would doubt CA could support a self-sustaining wolf population. CA might be able to sustain a handful of packs that were connected to a few packs in OR but I believe any large population or one that could be contiguous and large enough to effect native prey density or distribution, or cause significant livestock depredations or result in a situation that some might perceive as resulting in 'trophic cascades' in highly unlikely. The blocks of theoretical suitable habitat in N. CA are so small and fragmented; many contiguous pack territories are unlikely. I think the stakeholder approach is a good way to develop a CA wolf plan, but suspect it will be difficult for people to accept 'facts' over strongly felt opinions on both sides, but that is the nature of human views about wolves.

Overall, I really have nothing substantive to add. All and all this draft document is a very good scientific review and well written product. I think you are correct that in time it is certain more lone wolves will occasionally enter CA and in time a pack will try and form. But I think there is certainly no rush to do anything different because of that. Once you have a persistent pack or two (which could be many years away) you will have plenty of time and lots more data to decide a course of action.

If you have any questions regarding my thoughts please do not hesitate to contact me. Good luck.

STATE OF CALIFORNIA
NATURAL RESOURCES AGENCY
DEPARTMENT OF FISH AND WILDLIFE

REPORT TO THE FISH AND GAME COMMISSION

A STATUS REVIEW OF THE **GRAY WOLF** (*Canis lupus*) IN CALIFORNIA

Photo courtesy of ODFW

CHARLTON H. BONHAM, DIRECTOR
CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

October 2013 - PRELIMINARY DRAFT FOR REVIEW

Report to the Fish and Game Commission

A Status Review of the Gray Wolf in California

Comments Ed Bangs 10/23/2013, see last page

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Appendix A. California Historical and Current Wolf Records

Figure 1. Historical accounts of reported wolf observations, detections, or specimens in California. 2013.

Figure 2. Depiction of potential wolf habitat suitability in California from Oakleaf et al. (2006). Wolf OR7 locations were overlaid on the model output simply to illustrate where this individual dispersing wolf traveled, not for any validation purposes or testing of the model.

Figure 3. Depiction of the travels of gray wolf OR7 in California between December 2011 and March 2013. 2013.

Figure 4. Locations in Oregon of wolf packs and individual wolf OR7. http://www.dfw.state.or.us/Wolves/docs/Wolf_Use_Map_130719_0806.pdf. 2013.

Figure 5. Estimate of Deer, Elk, and Antelope Densities in California

Figure 6. Public and private ownership patterns in California. 2013.

EXECUTIVE SUMMARY

To be completed with final draft and will reflect the content of the Status Review

INTRODUCTION

Petition Evaluation Process

On March 12, 2012, the California Fish and Game Commission (Commission) received the "Petition to List the Gray Wolf (*Canis lupus*) as endangered under the California Endangered Species Act" (March 5, 2012; hereafter, the Petition), as submitted by the Center for Biological Diversity, Big Wildlife, the Environmental Protection Information Center, and the Klamath-Siskiyou Wildlands Center (collectively "Petitioners"). Commission staff transmitted the Petition to the Department of Fish and Wildlife (Department) pursuant to Fish and Game Code (FGC) section 2073 on March 13, 2012, and the Commission published formal notice of receipt of the Petition on April 13, 2012 (Cal. Reg. Notice Register 2012, No. 15-Z, p. 494). After evaluating the Petition and other relevant information the Department possessed or received, the Department determined that based on the information in the Petition, there was sufficient scientific information to indicate that the petitioned action may be warranted, and recommended the Commission accept the Petition (CDFG 2012). The Commission voted to accept the Petition and initiate this review of the species' status in California on October 3, 2012. Upon publication of the Commission's notice of determination, the gray wolf was designated a candidate species on November 2, 2012 (Cal. Reg. Notice Register 2012, No. 44-Z, p. 1610).

Status Review Overview

Following the Commission's action designating the gray wolf as a candidate species, and as per FGC section 2074.4, the Department solicited information from agencies, educational institutions, and the public to inform the review of the species status using the best scientific information available. This report contains the results of the Department's status review, including independent peer review of the draft report by scientists with expertise relevant to the gray wolf.

While the Department believes sufficient scientific information exists to conclude that wolves occurred historically within California, it is unknown to what extent, as the species was extirpated from the state by the late 1920's. At the present time, no individual, pack, or population of gray wolf is known to occur in California. With the recent gray wolf expansion in the western United States, a lone gray wolf known as OR7 dispersed from Oregon's wolf population to California in December 2011 and is now back in Oregon (as of Fall 2013). It is feasible that gray wolves will eventually attempt to establish a breeding population in California in the foreseeable future.

There is no specific, biological/ecological data available on the gray wolf in California to inform decision-making, however, the Department believes there is relevant and applicable scientific information from elsewhere concerning wolf biology, ecology, populations, management, and

potential threats. Because of the differences in natural communities, management, and possibly other human-related factors between California and other western states and provinces, the degree of certainty to which information on wolf status and conservation from other locations can be used to predict a future status in California is unknown. The purpose of this status review is to fulfill the mandate as required by FGC 2074.6 and provide the Commission with the most current scientifically based information available on the gray wolf in California and to serve as the basis for the Department's recommendation to the Commission.

BIOLOGY AND ECOLOGY OF THE GRAY WOLF

Species Description

The gray wolf is the largest wild member of the dog family (*Canidae*). Depending upon subspecies, the range of sizes in both sexes is widely variable. Throughout their range, female adult gray wolves weigh from 40-120 pounds (18-55 kg), and measure from 4.5-6 feet (1.37-1.52 m) in total length. Adult males, which are generally slightly heavier and larger than females, vary in weight from 45-175 pounds (20-80 kg) and in total length from 5-6.5 feet (1.27-1.64 m). Shoulder height ranges from 27-32 inches (700-800 mm) (Mech 1974; Paradiso and Nowak 1982). Typical weights for adult female gray wolves in Montana are 80-100 pounds, and for adult males are 90-110 pounds (WDFW 2011).

Wolves are apex carnivores that prey on large herbivores such as elk, moose, bison, and deer. Because they occupy the top of the food chain, wolves can influence other species on all trophic levels from predators and prey to plants (USFWS 1987; Mech and Boitani 2003). Although mortalities to wolves have occurred from mountain lions, bears, from other wolves, and other large mammals, for the most part they do not have any natural predators (Mech 1970; Robbins et al. 2010). Wolves tend to select more vulnerable or less fit prey and are known to selectively hunt young or older animals, and those injured or diseased in greater proportion than healthy adult individuals (e.g., Mech 1970, Fritts and Mech 1981, Kunkel and Pletscher 1999; Stahler et al. 2006).

Systematics

Classification: The taxonomy of wolves in North America is complex, made more challenging by the fact that wolves were extirpated over large portions of their range prior to the earliest attempts to scientifically categorize the subspecies (Chambers et al. 2012). Scientific discussion of wolf taxonomy, including theoretical subspecies designations and their possible historic ranges, continues to be debated (The Wildlife Society Position statement on Wolf Restoration 2013(?) or Chambers et al. or the USFWS National Wolf Planning that is now open for public comment?). Due to a scarcity of verifiable samples, very little is known about which subspecies of wolf occurred in California. The first comprehensive review of North American subspecies of *C. lupus* identified three subspecies which historically may have occurred in California: the Cascades Mountains wolf (*C.l. fuscus*) in Northern California, the Southern Rocky Mountains wolf (*C.l. youngi*) in the Mojave Desert region, and the Mogollon Mountain wolf (C.*l. mogollonensis*) in the Colorado Desert region (Goldman 1944, Hall 1981). All three of these once purported historical subspecies are now extinct. More recent revisions of North American wolf taxonomy by Nowak (1995, 2002, 2003) grouped the three historical California subspecies within the subspecies *C.l. nubilis*, the plains wolf. These revisions have recently been supported

by Chambers et al. (2012). It is also possible that the Mexican wolf subspecies (*C.l. baileyi*), recognized under both the historical and contemporary classifications), particularly dispersing individuals, may have occasionally entered the extreme southeastern corner of California.

The most recent work suggests that the different North American subspecies are derived from three separate historical invasions of the continent by wolves from Eurasia, the first wave being ancestors of *C.l. baileyi*, the second wave ancestors of *C.l. nubilis*, and the most recent wave ancestors of *C.l. occidentalis* (Chambers et al. 2012). Chambers et al. (2012) found genetic and physiological differentiation between *C.l. nubilis* and *C.l. occidentalis* and supported Nowak's (1995, 2002) delineation of the separate subspecies. (delete?)The genetic differentiation between *C.l. nubilis* and *C.l. occidentalis* indicates that each subspecies is more closely related to some European wolf subspecies than to each other. I believe this concept is highly theoretical and some (I for one) are suspect of it, so caution is warranted or at least should be acknowledged about ever changing theories of wolf taxonomy in North America.

The only wild wolf known to occupy California in recent times (OR7), entered California from an Oregon wolf pack. The Oregon wolf population was established from wolves emigrating from Idaho. The Idaho wolves originated from translocated wolves (*Canis lupus occidentalis*) captured in the Rocky Mountains of British Columbia and Alberta (Montana Fish, Wildlife, and Parks 2013). Wolves in certain Central Washington packs have been found to carry an admixture of both *C. l. occidentalis* and *C. l. nubilis* genes (Martorello 2013). Thus, the most recent wolf to occupy California, and the wolves most likely to colonize California in the future may be of a different subspecies than the wolves historically inhabiting the state. Information on wolf subspecies is presented for biological background. The Petition however, would apply to all *C. lupus* subspecies including the Mexican wolf.
Life Span: Wolves reportedly live an average of 4-5 years in the wild (Mech 2006), although they can live up to 15 years (Ausband et al. 2009); and have been reported living longer in captivity.

Geographic Range and Distribution
Of relevance to California, the gray wolf currently inhabits the Northern Rocky Mountain States, Washington, and Oregon. This distribution is largely due to the efforts of the US Fish and Wildlife Service (USFWS) who drafted the Northern Rocky Mountain Wolf Recovery Plan in 1980 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 revised plan recommended recovery through natural re-colonization primarily from Canadian wolf populations. Reintroduction was recommended for Central Idaho if natural re-colonization did not result in at least two breeding pairs there within 5 years.

In 1982, wolves from Canada began to naturally occupy Glacier National Park in Northwestern Montana, and in 1986 the first litter was recorded. In 1995 and 1996, 66 gray wolves from Canada were introduced to Yellowstone National Park (31) and Central Idaho (35) as non-

essential experimental populations (USFWS 2003), while the population in Northwestern Montana continued to increase naturally. 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 recent years, wolves have expanded into Washington and Oregon (CDFW 2011a).

Historical Perspective - California

The history of native California peoples suggests widespread distribution of knowledge and awareness of the wolf prior to European settlement. Of over 80 tribes that once existed, at least 15 were known to have separate words for wolf, coyote, and dog, and/or referenced the wolf in their stories, beliefs, and rituals (Geddes-Osborne and Margolin 2001, Newland and Stoyka 2013). This -is consistent with the hypothesis that wolves were widely distributed in California. Very well done historical view. I believe there were 2? papers about historical reports of wolves in CA published by Robert Schmidt, which did not have nearly as many observations as your review (his paper would not be the original source of information) but might need to check just to make sure you covered them. I believe they were part of the USFWS reclassification rule around 2003? Certainly wouldn't change your conclusions.

There are numerous historical records of wolves in California, dating back to the 1700s. A number of the records from the early 1900s are from reputable sources: state and federal agency staff, biologists, and experienced backcountry travelers. The historical wolf records in California were summarized during the initial 90-day petition evaluation and these wolf occurrences are described in Appendix A. Some of the anecdotal observations are ambiguous as to whether the observer was reporting a wolf or a coyote, and until recently, only four physical specimens existed from California.

The Department was aware of four presumptive specimens housed in the Museum of Vertebrate Zoology at the University of California, Berkeley that were identified as wolves (i.e. *Canis lupus ssp*. (2), *Canis lupus fuscus*, and *Canis lupus youngi*). The Department, in collaboration with the UCLA Conservation Genetics Resource Center, sampled all four of these specimens. Preliminary results indicated that two of the specimens were wolves that may have occurred naturally in California (CDFW and Conservation Genetics Resource Center, unpubl. data).

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) also 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 the southwestern subspecies than the gray wolf to the north. Indeed the genetic work supports this conclusion as the results for this specimen has only been observed in historical and current captive sample of the Mexican wolf (*Canis lupus baileyi*) (CDFW and Conservation Genetics Resource Center, unpubl. data).

The second 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 56 pounds, it was estimated that in good condition it would have weighed approximately 85-90 pounds (Grinnell et al 1937). The preliminary analysis of this animal suggests that it represents a common *Canis lupus* origin (CDFW and Conservation Genetics Resource Center, unpubl. data).

Of the two other California specimens; one was determined to be a domestic dog (collected in 1982 Tehama County) and interestingly analysis on the other specimen (collected in 1962 Tulare County) indicated its genetic information had only been observed in modern far-north Alaska-Northwest Territories. Based in part on the collection date of 1962, it is speculated that this specimen was purposefully brought into California by humans (CDFW and Conservation Genetics Resource Center, unpubl. data).

While limited, the available information suggests that wolves were distributed widely in California, particularly in the Klamath-Cascade Mountains, North Coast Range, Modoc Plateau, Sierra Nevada, Sacramento Valley, and San Francisco Bay Area. While the majority of historical records are not verifiable, for the purposes of this status review, the Department concludes that the gray wolf likely occurred in much of the areas depicted (CDFW 2011a) (Figure 1). Still, it is not possible to assess the utility and accuracy of the recorded and ethno historical information in reconstructing a map of historical gray wolf distribution in California, and the true historical distribution remains uncertain.

Historical Perspective – Oregon

The Department considers the range and distribution of gray wolves in Oregon to be relevant to California because Oregon is the most likely source for wolf dispersal into California. According to Bailey (1936), there were two native species of gray wolves in Oregon prior to being extirpated in the 1940s, *Canis lycaon nubilus* (east) and *C. l. gigas* (west), with ranges separated geographically east and west of the Cascade Mountains. *C.l. nubilus*, the species associated with the plains states, was called a variety of names including buffalo or plains wolf. *C.l. gigas* was known as the northwestern timber wolf, which was found along the Western Pacific Coast. Modern classification schemes do not recognize *C. l. gigas* as a subspecies and all wolves historically occupying Oregon would be classified as *C. l. nubilus* (Nowak 2002, Chambers et al. 2012).

Based on the historical information available for Oregon (Bailey 1936), it is possible that wolf distribution in Northern California would have been similar to that of the coastal and plains distribution found to the north, but the extent to which wolves ranged south into California is uncertain.

Reproduction and Development

In a healthy wolf population with abundant prey, a reproductive pair may produce pups every year. Females and males generally begin breeding as 2-year olds. Normally, only the dominant pair in a pack breeds, and packs typically produce one litter annually (Mech and Boitani 2003). The gestation period for wolves is 62-63 days. Most litters (1 to 11 pups) are born in early to mid-spring and average five pups. Pups are cared for by the entire pack, and on average four pups survive until winter (USFWS 2009).

Denning: 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 450 g (14.5 oz) (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 the young wolves are almost fully grown, they begin traveling with the adults.

Food Habits

Wolves are adapted to feeding on a diverse array of foods. As generalist carnivores, wolves can and do hunt prey that range in size from snowshoe hares (*Lepus americanus*) to bison (*Bison bison*), depending upon season and geographic location (Peterson and Ciucci 2003). In North America, wolves' winter diet is dominated by ungulates which are vulnerable to snow accumulation, and juveniles are the most common age class killed (Mech and Peterson 2003). In summer, North American wolves are able to consume a more diverse diet, and are often found to consume beavers, ground squirrels, coyotes, salmon, insects, and plant matter (Smith 1998; Peterson and Ciucci 2003; Darimont et al 2004), although ungulates represent most of the biomass consumed (Ballard et al 1987; Fuller 1989b).

Based on studies in Alberta, Canada, wolf predation on deer equaled that of elk (42% each); however, considering the biomass available to wolves, elk contributed 56% compared to 20% each for deer and moose (Weaver 1994). In British Columbia, black-tailed deer are the most common prey along coastal areas, and moose constitute much of wolf prey in the more southern areas (Darimont et al 2009; Mowat 2011). In the Northern and Central Rocky Mountains, elk are frequently the most important prey of wolves, but deer and moose comprise more in some areas (Huggard et al 1993; Boyd et al 1994; Mack and Laudon 1998; Arjo et al 2002; Husseman et al 2003; Kunkel et al 2004; Smith et al 2004; Atwood et al 2007). In areas where wolves and livestock co-occur, wolves have been known to kill and consume sheep, cattle, goats, horses, llamas, livestock guard dogs, and domestic pets (Bangs and Shivik 2001).

While OR7 was in California, he was observed pursuing a doe black-tailed deer. Based on evidence of known GPS locations (confirmed with wolf tracks and suspected wolf scat) it is believed that OR7 has fed on feral horse, bones at a livestock carcass pile, mule deer and mule deer fawns, and was suspected to have fed on ground squirrels. With the exception of the livestock carcass pile, it was not possible to determine if these food items were killed or scavenged (Kovacs 2013).

Wolf populations depend on the amount of prey biomass available (Packard and Mech 1980) and because prey abundance can vary from year-to-year, wolf population can also fluctuate (Fuller et al. 2003). Although mostly dominant when it comes to other predator species, competition for prey can occur with mountain lion, coyote, fox, and bear, as well as intraspecific competition with other wolf populations. The numerous mortality factors that prey

species populations are subject to, such as starvation resulting from poor habitat conditions, winter kill, predation, road-kill, disease, and sport hunting also affect the amount of prey available to wolves.

Although a larger pack is more effective in capturing prey, this manner of hunting has been reported to result in less food per member. In contrast, when lone wolves and wolf pairs are able to capture prey, the amount of food obtained per wolf is greater when they are successful, although they are less successful each time they hunt (Fritts and Mech 1981; Ballard et al. 1987, 1997; Thurber and Peterson 1993; Hayes and Harestad 2000). Single wolves have been known to bring down an adult moose (Cowan 1947). However, the amount of food that can be utilized when a large prey animal is taken by one or two wolves is limited and without a sufficient number of feeders, this surplus can be lost to competitors, scavengers, insects, and bacteria (Mech and Boitani 2003), even when cached. Therefore, sharing the surplus of large prey with family members appears to be the most efficient approach adult wolves can take to enhance the survival of their offspring and their fitness (Mech 1970, 1991; Schmidt and Mech 1997).

As wolves occupy the role of apex predator, the ecosystem can be modified by influencing behavior, distribution and abundance of prey species, with subsequent indirect effects on habitat (USFWS 1987) and by influencing distribution and abundance of other predators (Levi and Wilmers 2012). Additionally, wolves influence ungulate population condition, density,~~health~~ and distribution (White et al. 2005, 2012; Smith 2012).

Territory/Home Range

Wolf packs live within territories they defend from other wolves. In areas with a well-established wolf population, a mosaic of territories develops. Packs compete with each other for space and food resources through widespread, regular travel, during which they scent-mark as a means of maintaining their territorial boundaries. Howling at specific locations serves to reinforce these scent-marks (Mech and Boitani 2003).

Territory size is a function of interdependent factors. Wolf pack size, prey size, prey biomass, prey vulnerability, and latitude are all factors that have been recognized as influencing the size of wolf territories. The smallest recorded territory was 13 square miles in northeastern Minnesota, defended by a pack of six wolves (Mech and Boitani 2003). The largest territory on record, defended by a pack of ten, was 2,450 square miles in Alaska (Burkholder 1959). Wolf territories in the northern Rocky Mountains typically range from 200-400 square miles (322-644 km^2) (USFWS 2003).

Wolf territories are known to shift seasonally due to changes in movements of ungulate species (Mech and Boitani 2003). In summer, the den is the social center with adults radiating out in foraging groups of various sizes (Murie 1944; Mech 1970). In winter, packs will sometimes split up to hunt in smaller groups, and pack members may lag behind to visit old kills or disperse temporarily (Mech 1966).

The two primary functions of wolf travel within the territory are foraging and territory maintenance (i.e., boundary maintenance via scent-marking), of which they apparently do both simultaneously (Mech and Boitani 2003). Wolves range over large areas to hunt and may cover

30 mi (48 km). or more in a day. The breeding pair is generally the lead hunters for the pack. 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). Within-territory movements differ between pup-rearing season and the rest of the year (Mech et al 1998). While pups are confined to the den or other rendezvous sites, movements of adults radiate out from and back to that core position (Murie 1944). Once pups are able to travel with the adults, movements become more nomadic throughout the territory (Burkholder 1959; Musiani et al 1998).

Rendezvous Sites: After the natal den is abandoned, wolves are known to use "rendezvous sites" as specific resting and gathering areas in summer and early fall, generally consisting of a meadow complex and stream, with an adjacent forest (Murie 1944; Carbyn 1974). Rendezvous sites where cover is sufficient are sometimes used for training and hiding pups, once they have reached an age where the den is no longer capable of containing them (Mech and Boitani 2003).

Dispersal: Some wolves remain with their natal packs for multiple years, but most eventually disperse. Dispersing wolves may conduct temporary forays, returning several times before finally dispersing permanently (Fritts and Mech 1981; Van Ballenberghe 1983; Gese and Mech 1991), while others disperse once, never to return (Mech 1987; Mech et al 1998).

A few differences have been detected between the sexes in terms of dispersal characteristics. In some areas or years, males may disperse farther than females (Pullainen 1965; Peterson et al 1984), but at other times or locations, females disperse farther (Fritts 1983; Ballard et al 1987), so the average dispersal distance is about the same for both sexes (Mech and Boitani 2003). Wolves disperse throughout the year; however fall and spring tend to be the peak periods. Dispersal primarily during these periods suggests that social competition may be a trigger. In the spring when pups are present, aggression from the breeding adults may occur (Rabb et al 1967; Zimen 1976), and in fall when pups are traveling with adults, food competition may be at its peak (Mech 1970; Mech and Boitani 2003).

The average dispersing distance of northern Rocky Mountain wolves is about 60 miles, although 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 (GPS) technology, exceeding 6,000 miles (USFWS et al 2011). In general younger wolves disperse farther than older wolves (Wydeven et al 1995). This is possibly explained by older dispersers having more familiarity with the local terrain, and hence perceiving greater opportunity locally, whereas younger, more naive dispersers wander farther seeking security in areas not already inhabited by hostile wolves (Mech and Boitani 2003). There is some evidence that when wolves do travel long distances, they move in a manner that seems goal-directed (Mech and Frenzel 1971). One explanation is that, unable to establish a territory locally, the animal is predisposed to travel in a certain direction for some particular distance or time before looking to settle (Mech and Boitani 2003).

In recent years, dispersing wolves from British Columbia, Montana, and likely Idaho have established packs in Washington, and dispersers from Idaho have established in Northeastern

Oregon. The radio-collared male wolf OR7 dispersed into California in December, 2011 and remained in the state for over a year. OR7 returned to Oregon in March, 2013, and continues to remain in an area approximately 300 miles from any known wolf pack. Oregon Fish and Wildlife officials believe he is not accompanied by other wolves. As of the time that he left California, the Department estimated that he had traveled approximately 4,500 air miles.

Colonization: As wolves colonize or recolonize an area, the initial pack can proliferate quickly as conditions permit. This proliferation occurs in part through dispersal from the founding pack, and in part from additional immigration (Mech and Boitani 2003). Wolves in newly colonized regions may shift their territories over large areas. In these newly colonized areas territories tend to be exclusive initially, but may overlap with other territories as the region becomes saturated (Hayes 1995). In general, as areas become saturated with wolf territories, the boundaries may shift but the cores tend to remain approximately the same (Mech and Boitani 2003).

Habitat Use

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 a number of variables, including availability and abundance of prey, availability of den sites, ease of travel, snow conditions, livestock density, road density, human presence, topography and continuous blocks of public lands. While suitable habitat generally consists of areas with adequate prey where the likelihood of human contact is relatively low (Mladenoff et al. 1999) wolves are highly adaptable and can occupy a range of habitats, however, human tolerance to the presence of wolves may be an important factor (Mech 2006).

Wolves require adequate space for denning sites located away from territory edges to minimize encounters with neighboring packs and avoid other potential disturbances while birthing and raising pups. Den site selection and preparation may occur as early as autumn (Thiel et al 1997), with non-breeding members of the pack participating in the digging of the den and providing other general provisions to the breeding female. Rendezvous sites where cover is sufficient are sometimes used for training and hiding pups once they have reached an age where the den is no longer capable of containing them (Mech and Boitani 2003).

Habitat Suitability Modeling: There are studies that have modeled potential suitable wolf habitat in California. Carroll (2001) modeled potential wolf occupancy in California using estimates of prey density, prey accessibility and security from human disturbance (road and human population density). Results suggested that areas located in the Modoc Plateau, Sierra Nevada, and the Northern Coastal Mountains could be potentially suitable habitat areas for wolves.

The Department has similarly developed a model in anticipation of a gray wolf conservation plan. Oakleaf et al. (2006) developed a model for the Northern Rocky Mountain (NRM) gray wolf Distinct Population Segment (DPS) and reported positive correlations with environmental factors (elk and forested habitats) and negative correlations between wolf occupancy and

anthropogenic factors (human density and domestic sheep). The U.S. Fish and Wildlife Service developed a habitat suitability model for Idaho, which the Department modified for California based on the Oakleaf criteria; percent forest cover, human population density, elk density, and domestic sheep density. Currently, the Department believes that the Oakleaf model (subsequently validated in 2010 with respect to wolf survivorship) provides a rigorous approach and is based on fewer assumptions than other modeling efforts that have been conducted and which cover California (Figure 2). I agree, a model would have to assess livestock in any determination of theoretical wolf pack habitat suitability. The key to models is recognizing lone wolves can and do move through many habitats that are unsuitable for persistent pack occupancy. Persistent pack presence relies on large blocks of contiguous suitable habitat, which appear present but rare in N. CA.

CONSERVATION STATUS

In assessing conservation status for the gray wolf in California, the Department considers the status of the gray wolf in Oregon to be relevant, as wolves from Oregon would be the most likely source population in the future. Consequently, the status assessment as it relates specifically to animal population, trend, and distribution includes a brief overview of Oregon.

In regard to the Mexican wolf, the Department is of the understanding from both the U.S. Fish and Wildlife Service, and the Arizona Game and Fish Department, that the likelihood of wolves entering California from Arizona is so remote that the Fish and Wildlife Service did not include California as potential range in developing the recent Distinct Population Segment (DPS) for this subspecies. Because occurrence in California is so unlikely by the Mexican wolf, and the scientific information on wolf use of the deserts of Southern California is non-existent, the Department has concluded conducting a reasoned status evaluation for this animal is not feasible as it is for the gray wolf in northern California.

Trends in Current Distribution and Range

California: With no gray wolf population, there is no trend in distribution or range in California and it is not possible to assess a trend as there is no scientific data available for California. The only known natural occurrence of the gray wolf in California since extirpation has been OR7, the wolf that traveled south from Oregon (CDFW 2011b). The dispersal pattern of OR7 during his visits to California is provided but the Department does not consider the travels of this individual to constitute a geographic area of wolf range. At the time of this status review OR7 is in Southern Oregon (Figure 3).

Oregon: In 1999, dispersing wolves were first observed in Oregon. As the reintroduced Idaho wolf population expanded, increasing numbers of dispersing wolves eventually established packs in both Oregon and Washington by 2009. The range of the gray wolf in Oregon has been expanding since that time.

In 2010, there were two known packs; the Imnaha (OR7 pack of origin) and the Wenaha packs with 15 and 6 wolves, respectively. In 2011, three additional packs were known in Oregon; the Walla Walla, Snake River, and Umatilla River packs. In 2012, one more pack was established;

the Minam pack. There is also another known pair located in that same general area, the Sled Springs pair that has an undetermined breeding status. In addition, there are at least three wolves are not associated with any pack (ODFW 2011), including OR7. As of June 2013, there are 6 established wolf packs in Oregon, all in the northeastern part of the state (Figure 4). Because of the growth in the Oregon wolf population, an expansion southward appears feasible in the foreseeable future.

Population Trend

California: There is no known population of gray wolf in California, therefore population estimate and trend information does not exist.

Oregon: The current abundance of Oregon wolves through 2012 is estimated by ODFW to be a minimum of 46 animals. The Oregon wolf population has increased each year from 2009 through 2012, with the minimum number of wolves reported to be 14, 21, 29, and 46 animals, respectively (ODFW 2013a). The true number of wolves in Oregon was undoubtedly higher each year as not all wolves were likely detected. Whether this rate of increase will continue, or whether a similar rate of population growth could be expected to occur in California if a wolf pack(s) became established, is uncertain and is likely dependent on a number of factors, including habitat suitability and prey availability.

Habitat Essential for Continued Existence of the Species

Fish and Game Code section 2074.6 requires that a status review include preliminary identification of the habitat that may be essential to the continued existence of the species.

Wolves are wide ranging and can use varied habitats. Habitat used by wolves in other western states appear similar to California forest and rangeland habitats. These observations and an understanding of wolf life history, are considered relevant in developing a potential model of essential habitat for California. These factors contribute to the below discussion of potential, or possibly, essential habitat should a gray wolf population occur in California. Large, undeveloped tracts of public land provide suitable habitat and are generally required for the establishment of wolf populations in North America (Paquet and Carbyn 2003). It is believed these large tracts of undeveloped land reduce human access and thereby provide some level of protection for wolves (Mech 1995). However, as gray wolves expand their range in the U.S., they may increasingly inhabit areas near 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.

However, as no gray wolves are known to inhabit California, habitat essential for the *continued existence* of wolves is not presently at issue. Additionally, as no scientific data on habitat selection or preferences of gray wolf in California exists, it is not possible to describe essential habitat with certainty.

Factors Affecting Ability of the Gray Wolf to Survive and Reproduce

Degree and Immediacy of Threats: As far as the Department is aware, the gray wolf does not presently (September 2013) inhabit California. Consequently, there is no immediate threat to

gray wolf survival and reproduction in California. However, due to the potential for wolves to become established in the future, the following factors may become relevant. Unless, and until, the gray wolf becomes established in California and first-hand scientific information becomes available, there is uncertainty in predicting the potential significance of these factors under California conditions.

Human Predation on Wolves: Fear of wolves has been passed down from generation to generation for centuries, partially due to danger that large predators pose to humans. A factor contributing to the legacy of fear is that historically, prior to modern medicine, bites by rabid wolves almost always resulted in death. Cases of "furious" wolf attacks have been documented with one wolf sometimes biting large numbers of people (Linnel et al. 2002).

Negative human attitudes toward wolves are largely based on a perceived threat to personal safety or livelihood. Early settlers and explorers viewed wolves and other large predators as a serious threat due to direct losses of livestock, but also as competitors with humans for the large ungulates which early settlers relied on in part for food. Wolves, grizzly and black bears, and mountain lions were actively killed as settlers moved west and were removed from most of the lower U.S. to allow a safe environment for the establishment of farms and ranches throughout the west. While nationwide, the overall loss of cattle due to wildlife is about 5.6 percent (219,900 cattle lost), wolves contributed 0.2 percent (8,100 cattle lost) of the total reported losses (3,992,900 total cattle lost). Probably need to qualify this data, as this statement could be misleading, as most cattle or not in areas occupied by wolves. More than half of all predator losses are caused by coyotes (USDA 2011). However, public perceptions of wolves attacking people and the losses of livestock, continues to influence human attitudes toward wolves. Studies focused on the attitudes of people toward wolves as wolves have been reintroduced in the U.S. have shown a trend of increasing tolerance in some areas (Bruskotter et al. 2007), and a decreasing tolerance in others (Chavez et al. 2005).

Negative attitudes toward wolves would still likely be in place in California if the species establishes itself. However, development of sound management and conservation strategies involving California's diverse stakeholders, and communicating those strategies to the public may reduce the potential for this to be a threat by increasing human tolerance for wolves in the state.

Damage Control: The conflict between wolves and livestock producers, and the resultant take of wolves under depredation/damage control, constitutes a threat to individual wolves at a minimum and may represent a potential threat in California if the gray wolf populations were to become established in the state. Washington and Oregon have criteria to determine if wolves have become habituated to killing domestic animals and has steps to remove them, as necessary (ODFW 2012, WDFW 2012). However, the wolf populations in the Northern Rocky Mountains, and in Washington and Oregon, are continuing to increase in the presence of this threat suggesting that it is not likely a significant issue to maintaining wolf populations in these states. True, but it might also be worth noting that large portions of Montana, Wyoming and parts of Idaho have been routinely crossed by dispersing wolves and that for nearly past 30 years have (and may never) support a persistent wolf pack. Point being in some habitats wolves are so susceptible to human-caused mortality or are likely to casue so many conflicts

with domestic animals those habitats become unsuitable to support wolf packs due to high levels of illegal and legal human caused mortality. Could probably cite the USFWS et al annual report maps of NRM wolf packs. See you addressed this below.

Other Human Influences: Human-caused mortality ~~take~~ of wolves is the primary factor that can significantly affect wolf populations (USFWS 2000, Mitchell et al. 2008, Murray et al. 2010, Smith et al. 2010). Thus, conservation and recovery efforts for the wolf have been successful to a substantial extent by limiting human-caused wolf mortality and allowing populations to recolonize in several states. In recent years, public hunting of the gray wolf has been initiated in some states (such as Idaho and Montana) for species management purposes, resulting in substantial harvest of wolves, however, the long-term effects on the species population dynamics are not yet known.

Human population growth and increased human use of open spaces through urban and residential development, natural resource utilization (i.e., timber, mining, water use, agriculture, etc.), and increased access to public lands for human recreation all have the potential to impact habitat for wolves and influence the ability for populations to become established and sustainable over time (Carroll 2001, USFWS 2013). Other potential impacts to wolves could occur from disease, vehicle strikes, urban growth, road development, highways (which pose barriers to wolf movements), dams, habitat loss and other development.

Prey Availability

In most northwestern states, deer, elk and moose are the primary prey species for wolves (USFWS 1987). In Oregon and in the Great Lakes area, wolves prey on deer more when larger ungulate species are unavailable (ODFW 2010; USFWS 1987). In California, wolves would be expected to rely heavily on deer because elk population numbers are far fewer across the landscape. Wolves will take smaller prey or scavenge when necessary, but survival? tends to rely on~~prefer~~ hunting larger ungulates (CDFW 2011a).

In California, it is unknown whether the available habitat supports or is capable of supporting, adequate numbers of the primary prey species, elk and deer, to sustain a wolf population combined with the other factors affecting these species. In northern California, where the gray wolf would likely first colonize, the current elk population is estimated to be approximately 7,000 animals across approximately 28,000 sq miles of wildland in the eight northern counties, and occurs at low densities except in the coastal zone (Figure 5). California's mule deer populations have been in a slow and steady decline since they peaked in the 1960's, and are down an estimated 50-70 percent in the northern counties where the habitat would otherwise appear to be potentially suitable for gray wolf. Additionally, California's other predators on deer and elk, specifically mountain lion, bobcat, coyote, and black bear, are considered common species and black bear have been increasing in population since the 1980s. The mountain lion (estimated population of 4,000-6,000 statewide based on a 1970s estimate) is a specially protected mammal for which no hunting can occur. The black bear population in California has approximately tripled in the past 25 years to over an estimated 30,000 animals statewide, with fewer than 2,000 typically harvested annually through hunting in most years (http://www.dfg.ca.gov/wildlife/hunting/bear/docs/2011BearTakeReport.pdf). These species would compete with the gray wolves for food. It is unclear what effect the presence of wolves

in the state would have on the populations of black bears and mountain lions, although competition for resources would be expected to reduce the populations of these competing predators and the proportion of game animals taken by each of them might likely change. In California, the habitat for enough ungulate prey to sustain a viable wolf population in California is in need of restoration to increase deer and elk populations. I believe this is a bit of an over-statement, wolves can persist at very low prey density and often do so by just using bigger territories. The question really isn't about native prey density as much as it is conflicts with human activity, largely domestic animals and having large enough blocks of suitable habitat to support a pack so that mortality along the edges of the pack territory does not exceed its recruitment rate. Those large of areas with year-round wild prey appear rare in CA.

Habitat suitability models for the gray wolf (Carroll et al. 2001, Oakleaf et al. 2006, CDFW in prep.) take into consideration the estimated abundance of elk prey, but not deer prey. The Department is gathering information to adapt the Oakleaf et al. (2006) model to reflect our current information on the distribution and density of large ungulate prey in California (essentially combining Figure 2 and Figure 5). Until wolves attempt to enter and become established in California, it is not possible to determine with certainty whether a population can be sustained by the existing prey available in the state.

Competition

Competition for resources (e.g. food, space) occurs between wolves and other predators. Mountain lion, black bear, coyote, bobcat, and fox species are carnivorous animals that would likely be the most affected by wolves becoming established in California. It is unknown what the interspecific relationships among the gray wolf and other predators would be, in particular for species that have unusual status already in California (the Sierra Nevada red fox is threatened under the California Endangered Species Act and the mountain lion is a "specially protected mammal" per legislation). Mountain lions are a common predator in California's deer ranges and are protected from take or harvest through legislation. It is likely that the mountain lion would be the primary competitor with wolves for deer. In Yellowstone National Park, as wolf numbers increased, mountain lions shifted to higher elevations and more north-facing slopes in the summer and in more rugged areas in the winter (Bartnick et al. 2013). Home ranges for wolves and mountain lions overlapped, but mountain lions avoided areas recently occupied by wolves (Kortello 2007). Whether these patterns would hold in California is uncertain as the habitats, weather, and prey base including ungulate migration patterns are different. No scientific information available to the Department suggests that competition with other predators is likely to pose a significant threat to wolves in California. Agree, they all evolved together and usually just modify their behavior to make it work.

Black bears, another potential predator in California, are known to coexist with gray wolves although conflicts around wolf dens, bear dens, or food have resulted in either species being killed. Generally, adult bears are rarely killed by wolves but injured, young, or old bears have been known to be prey in some circumstances (Murie 1944, Ballard 1982, Paquet and Carbyn 1986, Koene et al. 2002). Black bears can also have impacts to ungulate populations and are known to hunt and kill the fawns of elk and deer to the point of having a substantial impact to the young-of-the-year in a given region (Rogers et al. 1990, White et al. 2010).

Small Population Size

The threats inherent to small, isolated populations would apply to any wolf or initial wolf population that may attempt to colonize California. A small wolf population would likely be less able to withstand and rebound from natural and human influenced causes of mortality . A small population size increases the risk of extirpation through demographic, environmental, and random genetic changes over time, particularly if the population is isolated; as well as through deleterious effects associated with low genetic diversity (Traill et al. 2007, Traill et al. 2010). The degree to which colonizing wolves are able to breed with and exchange individuals between packs in Oregon or other neighboring states will influence the significance of the threat posed by small population size.

The growth of wolf populations in and around the northern Rocky Mountains since 1995 provides evidence that the gray wolf, with appropriate conservation actions, can apparently overcome the threats associated with a small population size.

Climate Change

Climate change potentially offers both benefits and challenges for a future gray wolf population in California. Many prey and predator species have shifted their distributions towards higher latitudes and elevations due to climate change (Thomas 2010; Chen et al. 2011). It is predicted that temperature will increase and precipitation will decrease in California in coming decades (Van den Hurk et al. 2006; Cayan et al. 2012). Top consumer species at higher trophic levels have greater metabolic needs and smaller population sizes than those at lower trophic levels (Voigt et al. 2003; Vasseur and McCann 2005), which makes them more sensitive to climate change (Gilman et al. 2010). Other climate change predictions may influence the habitat's ability to sustain wolf populations in California. For example, reduced forest vegetation in the Sierra Nevada and Cascade Mountains (Lenihan et al. 2008) due to increased temperatures and catastrophic fires (Fried et al. 2004) could limit suitable habitats for wolves, especially in terms of denning and cover requirements. Conversely, with increased wildfire in forest communities, early successional habitats that result would likely provide benefits to large herbivore prey species. Consequently, it is unknown what affect climate change will have on wolf and prey populations or distributions in California.

Diseases

Wolves are vulnerable to a number of diseases and parasites, including, mange, mites, ticks, fleas, roundworm, tape worm, flatworm, distemper, cataracts, arthritis, cancer, rickets, pneumonia, and Lyme disease. In colder northern regions, external parasites tend to be less of a problem (Idaho DFG 2013). Whether these diseases and parasites have, or would have, substantial impact on a gray wolf population in California is unknown. The primary known diseases and parasites are described below.

Canine distemper and canine infectious hepatitis: Both diseases are known to occur in wolves and more recently canine parvovirus has become prevalent in several wolf populations (Brand et al. 1995).

Mange: Mange consists of tiny mites that attach themselves to a wolf's fur or skin. In sarcoptic mange, intense itching occurs due to female mites' burrowing under the wolf's skin to lay eggs. In demodectic mange, the mites live in the pores of the skin and cause little or no itching. The symptoms of mange include skin lesions, crusting, and fur loss. Wolves that suffer mange in the winter lose fur that protects them resulting in hypothermia and possibly can cause them to freeze to death. Might cite recent Jimenez et al. 2012? See USFWS annual reports for the citation? Or the Kreeger disease chapter in Mech and Boitoni?

Canine Distemper: Canine distemper is a very contagious disease caused by a virus. The disease is often centers on the skin, eye membranes, and intestinal tract, and occasionally the brain. Symptoms include fever, loss of appetite, and a discharge from the eyes and nose. Diarrhea and dehydration may follow and in final stages seizures may occur (Brand et al. 1995). Canine distemper can result in periodic population declines in wild wolves (Almberg et al. 2010, Almberg et al. 2011)

Canine Parvovirus: The transmission of disease from domestic dogs, e.g. parvovirus, is a grave conservation concern for recovering wolf populations (Paquet and Carbyn 2003, (Smith and Almberg 2007). Recently, two wolves and two pups in Oregon were found to have died from parvovirus (ODFW 2013b). The disease is not thought to significantly impact large wolf populations, but it may hinder the recovery of small populations (Mech and Goyal 1993). It is currently unknown how much this disease may affect Oregon wolf populations or potential future California populations.

Canine Adenovirus (Hepatitis): Infectious canine hepatitis (ICH) is a contagious disease of dogs that can effect wolves, coyotes, foxes, bears, lynx and other carnivores with signs that vary from no visual signs to a slight fever and congestion of the mucous membranes to severe depression, marked low white blood cell count, and blood clotting disorders. Although controlled by immunization in domestic animals, periodic outbreaks, which may reflect maintenance of the disease in wild and feral hosts, reinforce the need for continued vaccination of domestic pets (Merck 2013).

Rabies: Contrary to popular myth, rabies is very rare in wolves. Although rabies is fatal to wolves and has been detected in wild wolves in North America, the disease is not thought to be a major factor in the population ecology of wolves (Theberge et al. 1994).

Parasites: Roundworm, tape worm, flatworm, mange, mites, ticks, and fleas.
Echinococcus granulosus (E. granulosus): is a very small (3-5mm) tapeworm that requires two different animal species, a canid and an ungulate, to complete its lifecycle and is already naturalized in CA (Idaho DFG 2013). It is not known to what extent these parasites may pose a threat to a future wolf population in California but they have not threatened wolf populations elsewhere.

Other Risk Factors

Overexploitation: The possibility of future increased access to areas that are currently roadless, for resource extraction (logging, mining, etc.) or high-impact recreational activities (off-road vehicles, winter snowmobiling, etc.) could impact a future gray wolf population. However, given

such activities are not substantially proposed in northern California, we do not consider them a potential risk factor under current public land management strategies. Other recreational activities (hiking, photography) could disturb wolves if they occur at sensitive times or in a manner that is especially disruptive if of long duration or high intensity. Poaching has the potential to impact wolf populations by affecting prey populations, or by the direct killing of wolves. The significance of these potential threats is unknown and would be difficult to quantify.

EXISTING MANAGEMENT, MONITORING, AND RESEARCH ACTIVITIES

Wolf Conservation and Management Strategies in California

Prior to OR7 arriving in California, the Department began developing background information in anticipation of such an event. A wolf planning document, Gray Wolves in California (CDFW 2011a), was completed that outlined basic information about the history, current conditions, potential for natural re-colonization and management implications. Once OR7 was in the state, the Department quickly worked with the USFWS and the USDA Wildlife Services to develop an interagency coordination plan to respond to events involving a wolf as needed (USFWS/APHIS/CDFW 2012).

At the time of this status review, the Department is working on a wolf plan for California. The primary goal of this plan is to develop a strategy for the long-term conservation and management of wolves in the state. The plan is on a schedule to be approved and in place by early 2015. The Department recognized the need to be proactive in developing a strategy for coordination with federal partners and to be responsive to the questions and concerns by a variety of stakeholder groups. A part of that preparation will require more detailed assessments of potential habitat capability in California. Additionally, the Department's deer and elk programs are working toward development of more comprehensive assessments of prey species given the potential for the gray wolf to become established in California.

Monitoring

Coordination with the Oregon Department of Fish and Wildlife and the USFWS will continue in the effort of tracking radio and GPS collared wolves from Oregon packs. Additionally, general wildlife surveys that occur along the Northern California border will continue annually to monitor for a number of wildlife species, including wolves when yearly assessment work occurs in areas that might potentially detect dispersing wolves from Oregon. It is anticipated that monitoring will be considered as part of the wolf plan that is in the beginning stages of development by the Department.

Current Land Management Practices

The following land management summary applies to forests and ranges of California that could potentially be inhabited by gray wolf in the future. To the Department's knowledge, none of the current land management planning efforts being implemented have specific objectives, prescriptions, or actions related to the gray wolf. But, wolves are such generalist predators that it is unlikely any specific land management actions would be needed in the future (?).

Land management practices in California in areas of potential wolf habitat vary with ownership. Large areas of mid-elevation forest and meadow vegetation communities with low human density are the primary criteria used to estimate potential wolf management areas, although wolves can sustain a population in a variety of different habitat types. Fifty five percent (55%) of the forest land in California is publicly owned, the vast majority of which is owned and managed by the federal government (CDF 2010). The remaining 45% is privately owned. Most of the federal forest land in California is owned and managed by the United States Department of Agriculture Forest Service (USFS). The USFS manages 4,355,231 ha (10,762,000 ac) of conifer forest land in California (CDF 2010). The National Park Service (NPS) is another significant landowner in the species' potential California range, owning and managing 447,583 ha (1,106,000 ac) of conifer forest land (Ibid.). Although some potential habitat is owned and managed by California State Parks, the California Department of Forestry and Fire Protection, and other public agencies, most of the 2,692,376 ha (6,653,000 ac) of non-federal conifer forest land is privately owned (Ibid., Figure 6).

U.S. Forest Service Management: Land management on USFS lands is governed by the Land Resources Management Plan (LRMP) of each National Forest. The LRMPs of the Sierra Nevada National Forests were amended by the 2004 Sierra Nevada Forest Plan Amendment (SNFPA) which specifies that vegetation management strategies should be "aggressive enough to reduce the risk of wildfire to communities in the urban-wildland interface while modifying fire behavior over the broader landscape" (USDA Forest Service 2004).

On USFS lands, decisions about management actions are made giving consideration to the conservation of natural resources, restoration of ecological health, the protection of communities, as well as other considerations. Resource and ecological health considerations include conservation of the forest habitats utilized by the California spotted owl (*Strix occidentalis occidentalis*), northern goshawk (*Accipiter gentilis*), fisher (*Martes pennanti*), and American marten (*Martes americanus*) (USDA Forest Service 2004). Additionally, forest managers assess potential impacts and long-term effects management actions may have on Management Indicator Species (MIS), species identified to represent the health of the various habitats managed in each forest. These species evaluations are done at the local level and at the bioregional scale, which analyze impacts related to information from population monitoring data and/or habitat trends of each potential effected MIS, as identified in each forest. The land management decisions on National Forest lands with the greatest potential to influence future wolf populations are those related to the elimination of early seral forest habitats, fire suppression, catastrophic wild fire, public access, livestock grazing, and road construction.

Bureau of Land Management: BLM rangelands are interspersed all through northern California, and provide valuable range for elk and deer. BLM lands are managed for multiple uses and livestock grazing occurs throughout areas potentially inhabitable by the gray wolf. Additionally, in the northeastern part of California, wild horses are common and could potentially be preyed upon by wolves. As with National Forest lands, the management decisions with the greatest potential to influence a future wolf population are related to the elimination of early seral forest habitat types, fire suppression, catastrophic wild fire, livestock grazing, and public access.

National Park Service Management: There are a number of large, continuous areas of National Park Service lands with potentially suitable wolf habitat in California. Forest lands within the national parks and monument are not managed for timber production. The National Park Service preserves the natural and cultural resources found in each unique park setting. As with National Forest lands, the management decisions with the greatest potential to influence a future wolf population are related to public access.

State and Private Lands: Forest management on state and private conifer forest lands in California is regulated by the California Forest Practice Rules (FPRs) (Title 14, California Code of Regulations, chapters 4, 4.5, and 10) which implement the Z'berg-Nejedly Forest Practice Act. The FPRs require Registered Professional Foresters to prepare Timber Harvesting Plans (THPs), or similar documents (e.g. NTMPs) prior to harvesting trees on California timberlands. The preparation and approval of THPs is intended to ensure that potentially significant impacts to the environment are considered and, when feasible mitigated. Large blocks of contiguous industrial forest lands; particularly those with restricted public access, would be expected to be high quality wolf habitat should wolves become established in California. Public access policies vary by landowner and location.

Non-timber projects on state and private lands which are funded or authorized by public agencies are subject to the provisions of CEQA (e.g., highway construction, residential and commercial development, some energy projects). CEQA requires that actions which may substantially reduce the habitat, decrease the number, or restrict the range of any species which can be considered rare, threatened, or endangered (regardless of status under state or federal law) must be identified, disclosed, considered, and mitigated or justified (California Code of Regulations, Title 14, sections 15065(1), 15380). However, like the FPRs, there are no established guidelines or minimum conservation measures related to species impacts or their mitigation measures.

Sensitive Species Designations

State, federal and non-governmental organizations designate "at risk" species (e.g., threatened and endangered species, California Species of Special Concern, Species of Greatest Conservation Need) and assess and rank their conservation needs. Status designations for the gray wolf are summarized below for California, Oregon, and Nationwide (Federal):

State of California Status: The Fish and Game Commission designated the gray wolf as a "candidate" for listing as endangered or threatened under the California Endangered Species Act (CESA), effective November 2, 2012 (Cal. Reg. Notice Register 2012, No. 44-Z, p. 1610). Should the species not be listed under CESA, existing statutes classify the wolf as a nongame mammal (California Fish and Game Code section 4152) and subject to regulation under the authority of the Commission. Additionally, California law regulates the import and possession of wolves (CFGC section 2150, 2157, 6530, and California Code of Regulations Title 14, section 670). Because of its current federal listing status (see below), any gray wolves entering into California are considered a federally listed endangered species.

State of Oregon Status: Gray wolves are listed statewide as endangered in Oregon under the state's Endangered Species Act and protected under the Federal ESA in Western Oregon.

Federal Status: The gray wolf is currently listed as endangered throughout portions of its historic range, including California, under the Federal Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*)(ESA) wherever it has not recovered or has been determined to be an experimental population. However, the USFWS is currently in a public comment period through October 28 to consider their proposed rule to remove the gray wolf from the list of threatened~~e~~ and endangered species, while explicitly identifying the Mexican wolf as an endangered species.

The Northern Rocky Mountains (NRM) gray wolf DPS was recently delisted in Montana, Idaho, Wyoming, Eastern Oregon, Eastern Washington, and North Central Utah due to meeting the recovery criteria of the NRM wolf recovery plan. Wolves that enter into California, and the western side of Oregon and Washington, are still protected by the ESA, which is administered and enforced by the USFWS. Under the ESA, the USFWS has lead responsibility for wolves in California. The Great Lakes gray wolf DPS has also been recovered and is currently delisted.

For species listed as endangered under the Federal ESA, activities that may result in “take” of the species are prohibited. The ESA defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."

MANAGEMENT RECOMMENDATIONS

The Department provides the recommendations below pursuant to FGC Section 2074.6 that directs the Department to include recommendations for management activities and other recommendations to aid in recovery of the species. However, the Department is currently leading the development of a California Wolf Plan, projected for completion in early 2015. This document will provide a comprehensive strategy for management of wolves in California for the future. Even though there currently are no wolves in California, the Department believes the following recommendations highlight actions that could help to conserve and manage gray wolves in California if they become established in the state. Recommendations are based on scientific information on the gray wolf and are consistent with the possibility that wolves could enter and become established in California in the foreseeable future. These are preliminary recommendations based on information developed by Oregon, Washington, and USFWS for the NRM DPS. As new information becomes available, recommendations will be further refined. The recommendations are:

- Communicate to the public that natural dispersal of wolves into California is reasonable foreseeable given the expanding populations in the Pacific Northwest. Inform the public with science-based information on gray wolves and the conservation and management needs for wolves in California, as well as the effects of having wolves in the State.
- If and when wolves establish in California, seek to conserve self-sustaining populations of wolves in the State
- Manage native ungulate populations in the State to provide abundant prey for wolves and other predators, intrinsic enjoyment by the public and harvest opportunities for hunters
- Manage the distribution of wolves within the State where there is adequate habitat

- Prevent the construction of, or eliminate, barriers that would restrict the movement of wolves or their prey in California.
- Implement large scale restoration and enhancement projects that would improve habitat quality and carrying capacity of native ungulates, primarily elk and deer.
- Develop management strategies to minimize wolf-livestock conflicts
- Develop an education and outreach plan to promote public understanding of wolves and wolf conservation. Present key facts on public safety, livestock depredation, and emerging wolf science. .
- Prioritize projects that conserve large tracts of land consisting of continuous, diverse forest habitats throughout Northern and Northeastern California.

SCIENTIFIC DETERMINATIONS REGARDING THE STATUS OF THE GRAY WOLF IN CALIFORNIA

California law directs the Department to prepare this report regarding the status of the gray wolf in California based upon the best scientific information. Under the pertinent regulation, a "species shall be listed as endangered or threatened ... if the Commission determines that its continued existence is in serious danger or is threatened by any one or any combination of the following factors: (1) present or threatened modification or destruction of its habitat; (2) overexploitation; (3) predation; (4) competition; (5) disease; or (6) other natural occurrences or human-related activities." (Cal. Code Regs., tit. 14, § 670.1, subd. (i)(1)(A).)

Also key from a scientific standpoint are the definitions of endangered and threatened species, respectively, in the Fish and Game Code. An endangered species under CESA is one "which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, over exploitation, predation, competition, or disease." (Fish & G. Code, § 2062.) A threatened species under CESA is one "that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts required by [CESA]" (*Id.*, § 2067).

The Department's scientific determinations regarding these factors as informed by, and following, independent peer review are summarized below. Because there is no current known population of gray wolves, or at the time of this status review, even a single known gray wolf in California, and because there is very little scientific knowledge available regarding historical populations that may have occurred in the state, all threats discussed are considered potential in nature. While the Department is identifying these factors, the actual significance of each as a real threat cannot be determined at this time.

1) Present or Threatened Modification or Destruction of Habitat
   - Modification or destruction of suitable denning and foraging habitat by human development (e.g. logging, or mining activities).
   - Increased human access and fragmentation of suitable habitat from new road construction.

- Modification or loss of suitable denning and foraging habitat, and associated prey species from wildfire.
- Native ungulate habitat reduction in habitat quality and quantity due to non-native plant species, competition with other herbivores (wild horses, domestic livestock), fire suppression, catastrophic wild fires, broadscale herbicide application for conifer release, loss of early seral forest habitat conditions due to absence of natural disturbances (natural fire regimes, promotion of late seral forest types)

2) Overexploitation

- Threat of unnecessary human exploitation of wolves due to fear for personal safety.
- Threat of human exploitation of wolves due to fear, or of loss of personal property (such as pets/livestock) or poaching.
- Disturbance from ecotourism and other recreation in wolf denning and foraging habitats.

3) Predation

- Predation on wolves by other wildlife species would not be expected to be a significant factor influencing wolves California.

4) Competition

- Competition with mountain lions, bobcats, black bears, and coyotes influencing prey availability and distribution.
- Harvest of elk and deer through sport hunting.

5) Disease

- Risk to colonizing populations due to a zoonotic disease event (e.g., rabies, parvovirus, canine distemper).
- Risk of the transfer of diseases between domestic animals and wolves.

6) Other Natural Occurrences or Human-related Activities

- Risk of mortality due to roads, highways and expressways.
- Dispersal barriers to movement, genetic exchange, pair establishment, and territory occupancy.
- Risks inherent to small populations.

The Department is not applying these potential threats to make any inferences toward the gray wolf (Mexican wolf) that occurs in the Southwest. Because the likelihood of this animal inhabiting California is so remote, the Department's only finding is that there is no scientific information to support a status review.

Summary of Key Findings

Under the protections afforded by the Federal Endangered Species Act and the reintroduction recovery efforts since 1994, wolves are recolonizing portions of their historical range. The population has recovered in the Northern Rocky Mountains and has provided a source

population for the edges of their range that is now being repopulated. Washington and Oregon have newly established populations that are expanding rapidly and making progress toward recovery goals. Oregon wolf recovery and management strategies describe population establishment statewide, and in time, establishment of wolves in California is considered possible. The habitat and prey base in California may be able to support a wolf population, based on habitat similarities with Oregon and the species' demonstrated adaptability for using a variety of habitats and prey species, but this remains uncertain, particularly with lower elk and deer densities in California. There currently is no wolf population in California for which to assess range, abundance, population trend, suitable habitat, or the potential threats.

Wolves are adaptive in prey selection and can occupy a variety of habitat types as long as they can find suitable ~~remote~~ areas to reproduce and feed without excessive human persecution?~~disturbance~~. Although wolves prefer elk when available, they will opportunistically take other large ungulates, other carnivore species, or smaller prey. The number of wolves that could ultimately be supported in California is unknown, as would be their impact on the prey populations and other wildlife species in California's ecosystems. Given the current expansion of wolves, and the growth of the wolf packs in Oregon, it is reasonably foreseeable that wolves will disperse into California and eventually establish reproducing packs The Department is currently in the process of developing a California Wolf Plan with the primary goal of providing for the long-term conservation and management of wolves in the state once they establish a population or packs in California.

A key finding is that the gray wolf is not currently facing or enduring any threat in California at this time. However, the primary threats that will face the gray wolf in California will likely be managing cohabitation with humans where there is a fear for personal safety, a threat to personal livelihood, or both; and the availability of suitable habitat and prey. Other threats that feasibly could affect colonizing wolves and sustainable wolf populations include limited competition, disease, small population size, limited genetic diversity, habitat fragmentation, road kill, human exploitation and other human disturbances. However, as seen since 1995 in the western U.S., wolves are a resilient species and can increase in numbers where adequate habitat and prey are available and conflicts with humans manageable.

LISTING RECOMMENDATION

In consideration of the scientific information contained herein, the Department has determined that the petitioned action is/is not warranted at this time.

PROTECTION AFFORDED BY LISTING

In the absence of gray wolf in California, listing would provide no protection to the species. The following is a discussion of potential protection that could be afforded to the gray wolf in California if listed under CESA. While the protections identified in this section would help to ensure the future conservation of wolves if and when they enter the state, significant protections are now in place and would continue if the wolf were not listed under CESA. These include its current federal status, the focus on long-term conservation and management through the development and implementation of the California Wolf Plan currently underway,

current CEQA requirements, and existing laws and regulations that make it illegal under State law to take wolves in California.

Protection under CESA

It is the policy of the State to conserve, protect, restore and enhance any endangered or any threatened species and its habitat. (Fish & G. Code, § 2052.) The conservation, protection, and enhancement of listed species and their habitat is of statewide concern (Fish & G. Code, § 2051(c).) As noted earlier, CESA defines "take" as hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill. (*Id.*, § 86.) Any person violating the take prohibition would be punishable under State law. As to authorized take, the Fish and Game Code provides the Department with related authority under certain circumstances. (*Id.*, §§ 2081, 2081.1, 2086, 2087 and 2835.) When take is authorized through an incidental take permit the impacts of the must be minimized and fully mitigated, among other requirements.

Increased protection of gray wolves following listing would also occur with required public agency environmental review under CEQA and its federal counter-part, the National Environmental Policy Act (NEPA). CEQA and NEPA both require affected public agencies to analyze and disclose project-related environmental effects, including potentially significant impacts on endangered, rare, and threatened special status species. Under CEQA's "substantive mandate," for example, state and local agencies in California must avoid or substantially lessen significant environmental effects to the extent feasible. With that mandate and the Department's regulatory jurisdiction generally, the Department expects related CEQA and NEPA review will likely result in increased information regarding the status of gray wolves in California as a result of, among other things, updated occurrence and abundance information for individual projects. Where significant impacts are identified under CEQA, the Department expects project-specific required avoidance, minimization, and mitigation measures will also benefit the species. While both CEQA and NEPA would require analysis of potential impacts to wolves regardless of their listing status under CESA, the acts contain specific requirements for analyzing and mitigating impacts to listed species. In common practice, potential impacts to listed species are examined more closely in CEQA and NEPA documents than potential impacts to unlisted species. State listing, in this respect, and required consultation with the Department during state and local agency environmental review under CEQA, is also expected to benefit the species in terms of related impacts for individual projects that might otherwise occur absent listing.

If the gray wolf species is listed under CESA, it may increase the likelihood that State and Federal land and resource management agencies will allocate funds towards protection and recovery actions. However, funding for species recovery and management is limited, and there is a growing list of threatened and endangered species.

Preparers

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Consideration of Public Comments

The following is a summary of the comments received since the gray wolf was advanced to candidacy in October 2012. The Department issued a public notice seeking information related to the status of the gray wolf in California. The letters and input received is available for review at the Department of Fish and Wildlife, 1812 Ninth St., Sacramento. Comments submitted were evaluated for any scientifically-based information that would inform the Department as it related to this status assessment of the gray wolf in California.

Letters in Support of Listing

- J. Capozzelli (letter) – April 22, 2013
- Battle Creek Alliance (letter) – May 5, 2013
- Society for Conservation Biology (letter) – May 6, 2013
- California Wolf Center (letter and 147 scientific documents) – May 6, 2013
- Center for Biological Diversity (letter) – May 6, 2013
- The Humane Society of the United States (letter) – May 6, 2013
- Project Coyote/Animal Welfare Institute (letter) – May 6, 2013 support listing
- Public Interest Coalition – May 6, 2013 (letter)
- Christina Eisenberg, PhD, (letter) – May 6, 2013
- >6,000 emails supporting listing

Letters Not in Support of Listing

- Jack Griffiths (letter) March 9, 2013
- County of Lassen, California (Resolution) April 17, 2013
- California Farm Bureau Federation, California Cattlemen's Association, and California Wool Growers Association (letter & research article) – May 6, 2013
- <100 emails opposed to listing

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Summary of Ed Bangs comments 10/23/2013

I found this to be an excellent science-based overview and it covered all the important points related to wolf biology and conservation. It might have used a few more literature cites here and there but generally they would have added nothing to the overall science being used and referenced or the conclusions reached.

I would caution that theory about wolf taxonomy has been changing rapidly every time a new technique, investigator, or approach comes along- for the past 30 years. I suspect that dynamic will not change in the near future. Seems like the various bureaucratic processes take 2-3 years to complete and taxonomic theory changes every 1-2 years so I would stay away from it as much as you can and be sure to qualify your analysis of the state of it as current literature suggests or some other wording. That being said your write up was very good.

The habitat model seemed as good as you could do, but from it I would doubt CA could support a self-sustaining wolf population. CA might be able to sustain a handful of packs that were connected to a few packs in OR but I believe any large population or one that could be contiguous and large enough to effect native prey density or distribution, or cause significant livestock depredations or result in a situation that some might perceive as resulting in 'trophic cascades' in highly unlikely. The blocks of theoretical suitable habitat in N. CA are so small and fragmented; many contiguous pack territories are unlikely. I think the stakeholder approach is a good way to develop a CA wolf plan, but suspect it will be difficult for people to accept 'facts' over strongly felt opinions on both sides, but that is the nature of human views about wolves.

Overall, I really have nothing substantive to add. All and all this draft document is a very good scientific review and well written product. I think you are correct that in time it is certain more lone wolves will occasionally enter CA and in time a pack will try and form. But I think there is certainly no rush to do anything different because of that. Once you have a persistent pack or two (which could be many years away) you will have plenty of time and lots more data to decide a course of action.

If you have any questions regarding my thoughts please do not hesitate to contact me. Good luck.

Lee, Rhianna@Wildlife

Subject: FW: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Attachments: Scientific Peer Review of California Department of Fish and Wildlife Draft Status Report of the Gray Wolf.pdf; Scientific Peer Review of California Department of Fish and Wildlife Draft Status Report of the Gray Wolf.docx

From: Carlos Carroll [mailto:carlos@klamathconservation.org]
Sent: Wednesday, November 13, 2013 3:20 PM
To: Loft, Eric@Wildlife
Subject: RE: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Dr. Loft,
Thank you for your invitation to provide a scientific peer review of the California Department of Fish and Wildlife Draft Status Report of the Gray Wolf. I have attached my review in pdf and Word formats.
Let me know if I can be of further assistance.

———

Carlos Carroll, Ph.D.
Klamath Center for Conservation Research
PO Box 104
Orleans, CA 95556

From: Loft, Eric@Wildlife [mailto:Eric.Loft@wildlife.ca.gov]
Sent: Friday, October 18, 2013 12:05 PM
To: carlos@klamathconservation.org
Subject: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Dear Dr. Carroll,

Thanks for your tentative agreement to review the subject document attached here (WORD document plus PDF of appendix/figures). Please review the attached letter (PDF) describing our intent, purpose, and request of you as a reviewer. I understand that plans may change and you may not be able to review the document for us. If that is the case please let me know as soon as practical. Otherwise, thank you very much in advance for your expertise and insight regarding the document.

Please contact me by email or telephone if you have any questions/concerns about this effort.

Sincerely,

Eric

Eric R. Loft, Ph.D, Chief
Wildlife Branch
California Department of Fish and Wildlife
1812 Ninth Street, Sacramento, CA 95811
(916) 445-3555; eric.loft@wildlife.ca.gov
Web: www.wildlife.ca.gov

Eric - I can review the document.

_____

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November 13, 2013

Scientific peer review of California Department of Fish and Wildlife Draft Status Report of the Gray Wolf

Dear Dr. Loft,

Thank you for your invitation of October 18, 2013, to provide a scientific peer review of the California Department of Fish and Wildlife Draft Status Report of the Gray Wolf. My research as a wildlife ecologist with the Klamath Center for Conservation Research in Orleans, California, has focused on habitat, viability, and connectivity modeling for a diverse group of threatened and endangered species ranging from large carnivores to rare and endemic plant species. I have also served on the Science and Planning Subgroup of the Mexican Wolf Recovery Team. I welcome the opportunity to use this expertise to evaluate the document. I group my review comments below by major themes, and note page and line number in parentheses (e.g., page 1 line 1 as (1/1)).

General strengths and weaknesses of the document and status review process

The status review is a commendable effort by CDFW to develop an information base to support decisions by the California Fish and Game Commission regarding the gray wolf in California. The management recommendations suggested (22/8-27) are generally sound and based on lessons from other regions where wolf conservation and management plans have already been developed. This section, along with some of the other portions of the document, provide a good start towards developing a foundation for future wolf conservation and management in California.

However, other portions of the document need considerable more work if they are to provide an adequate information base for the Commission. I particularly noted the frequent use (8 times) of phrases such as ”it is not possible to determine with certainty”. Complete certainty is never possible in wildlife management, but such general statements are not informative and do not substitute for a rigorous evaluation of the degree of uncertainty and conversely the strength of evidence supporting alternate hypotheses. While It is laudable the CDFW recognizes the need for proactive planning through development of a wolf plan (18/39-42), it is problematic to defer even basic analyses that should have been contained within the status review, until completion of a wolf conservation/management plan at some unspecified future date.

Habitat modeling issues

This is a central area of my expertise so I will devote most attention to this portion of the document. Generally, the comparison of the different habitat models (11/43) is overly superficial and uninformative. It is difficult to predict at this time which of several existing models (e.g., Carroll et al. (2006), Oakleaf et al. (2006), Larsen and Ripple (2006)) will have greatest success in predicting future wolf distribution in California. Each of these models have strengths and weaknesses. The model of

Carroll et al. (2006) is conceptual, whereas that of Oakleaf et al. (2006) is empirically developed using data from the Northern Rocky Mountains. Therefore, while the Oakleaf et al. (2006) model might be most informative in the Northern Rocky Mountains, it may be less generalizable outside that region.

The comparisons between models made in the status report are largely inaccurate. For example, the distribution model of Oakleaf et al. (2006) was not "validated" by Smith et al. (2010). Smith et al. (2010) modeled survival rather than distribution. More importantly, of the variables that Smith et al. (2010) found important (survival was lower in areas where mule deer were the most common wild ungulate prey, where cattle and sheep were more abundant, and where more land was in agricultural cover or state management), one (sheep density) is also in the Oakleaf et al. model. However, that does not "validate" the latter model, although it offers indirect support for both the Oakleaf et al. model and other models which use one of more of these variables. Larsen and Ripple (2006) similarly found that forest cover and public (primarily federal) lands were (positively in this case) correlated with wolf distribution.

In this context, a multi-model strength of evidence approach that overlaid in GIS predictions from all available models would be more informative here. In fact, such an analysis has been completed by FWS and is available to CDFW (see Figure 2 in: Society for Conservation Biology. 2013. Comments of the Society for Conservation Biology on the Listing of the Gray Wolf as a Threatened or Endangered Species under the California Endangered Species Act). Rather than using such already available data, the CDFW status review seems to avoid providing comprehensive mapped information on potential habitat or distribution. For example, the extrapolation of the model of Oakleaf et al. 2006 provided with the report (Figure 2) is only for a portion of state, without explanation of why similar data is unavailable for central and southern California. Rather than providing information, the document simply states (13/29) "as no scientific data on habitat selection or preferences of gray wolf in California exists, it is not possible to describe essential habitat with certainty." This boilerplate text is uninformative. Extrapolation of habitat models to new regions is common in wildlife management, and conclusions can be made with more or less confidence depending on the specific circumstances.

<u>Prey availability and ability as limiting factors in ability of California to support viable wolf populations</u>

The discussion of prey availability in the status review contains primarily unsubstantiated opinion rather than analyses of empirical data. The document (15/19) states "California's mule deer populations have been in a slow and steady decline since they peaked in the 1960's, and are down an estimated 50-70 percent in the northern counties where the habitat would otherwise appear to be potentially suitable for gray wolf." Given the extensive literature on wolf-prey dynamics (e.g. Fuller et al. 2003), it should be possible to analyze what wolf numbers could be supported by current deer and elk abundance in California. After that analysis was completed, the trend in deer numbers could be evaluated separately to evaluate if this wolf density could be sustained over time.

Solely stating that deer numbers have declined from a peak (perhaps associated with a changes in extent of early seral habitat due to trends in timber harvest) tells the Commission little about the potential for California prey populations to support wolves. Additional statements such as "Until wolves attempt to enter and become established in California, it is not possible to determine with certainty whether a population can be sustained by the existing prey available in the state" (15/40) are also uninformative as described above.

It is incorrect to state (15/35) that previously-published habitat models do not incorporate deer density. Both Carroll et al. (2001) and Carroll et al. (2006) based ungulate (deer and elk) density estimates on a surrogate metric (the "greenness" variable) but incorporated an empirically-modeled relationship between greenness and deer/elk density. The equation of Fuller et al. (2003) can also be used to assess the ability of California deer populations to support wolf populations. For example, a large proportion of northern California supports deer densities >= 2 per km^2. Even without considering elk abundance, the Fuller model would predict that such areas could support more than 10 wolves per 1000 km^2. I suggest that CDFW develop maps of potential wolf abundance from available deer/elk density estimates (Figure 5) and the Fuller et al. (2003) equation. The statement (24/19-22) that "habitat and prey base in California may be able to support a wolf population, but this remains uncertain, particularly with lower elk and deer densities in California" is not supported by available data. Previous analyses (Carroll et al. (2001, 2006) and predictions based on the Fuller equation strongly support the conclusion that California has sufficient prey to support a wolf population at current deer and elk densities. CDFW has presented no evidence to the contrary, but rather has neglected to analyze available data that would support or contradict their statement.

<u>Factors related to wolf mortality as limiting factors</u>

Although there is support for concluding that prey abundance is not limiting for wolf populations that may inhabit California, it is less evident whether availability of secure habitat (areas with low mortality risk) will be limiting. The status review correctly identifies overexploitation (18/20) as an important risk factor. Mortality is a function of both the lethality of each person encountered (e.g., whether hunting is permitted) and the frequency with which wolves encounter humans. The number of roads and human population density serve as useful surrogates for encounter frequency even though human attitudes, regulations, and consequently lethality, vary between regions (Carroll et al. 2006).

In most regions of North America, the predominant factor in facilitating human-associated wolf mortality is road access. In California, timber harvest, especially on private industrial timber lands (which constitute 45% of forest land in California (19/25)), often involves creation of dense networks of access roads. Therefore, this variable should be evaluated and any potential trends which may reduce the extent of suitable habitat should be noted in the document. I agree that "large blocks of contiguous industrial forest lands; particularly those with restricted public access, would be expected to be high quality wolf habitat" (20/33). However, access management policies (e.g., locked gates) are not always

effective at reducing wolf mortality given areas may remain frequently used (e.g., by employees). The potential role of industrial forestlands is a substantial source of uncertainty in projecting future wolf distribution in the Pacific states. Although other areas may become more important over time, wolf distribution in western North America is currently largely associated with large blocks of unroaded public lands. Some such areas do exist within California, especially in the southern Sierra Nevada. Supporting the conclusion that availability of secure habitat will be more limiting to California wolves than prey availability, Carroll et al. (2006) estimated the potential number of wolves in California as between 200-300 animals, which is far below an estimate based on prey availability (e.g., from the Fuller equation).

Metapopulation connectivity and dispersal, especially from and to Oregon wolf populations

Given that California's wolf population will likely remain smaller than those in the Northern Rocky Mountains, it is important to consider the degree to which connectivity with adjacent populations in Oregon will support persistence of California wolf populations (16/32). A recent study (Carroll, C., R. J. Fredrickson, and R. C. Lacy. 2013. Developing Metapopulation Connectivity Criteria from Genetic and Habitat Data to Recover the Endangered Mexican Wolf. Conservation Biology [Online Early]) found that populations connected by at least 0.5 genetically-effective migrants per generation were projected to experience reduced threats from small population size (e.g., lower risk of loss of genetic diversity and consequent effects on viability).

Although the document correctly notes (16/36) that Northern Rocky Mountain wolves have shown no known problems due to small population size, those reintroduced populations were created from a deliberately diverse group of founders from different areas of western Canada. Founder diversity might be lower in California wolf populations founded from a few dispersers. Again, this suggests the importance of maintaining connectivity to Oregon wolf populations.

Historic distribution and current habitat availability for the Mexican wolf in southeastern California

Due to serving on the Science and Planning Subgroup of the Mexican Wolf Recovery Team, I have reviewed available data on that subspecies. I suggest that the status report must consider the historical distribution and currently available habitat for Mexican wolf habitat in southeastern California more extensively. For example, the statement (12/11, 24/6-9) that "the likelihood of wolves entering California from Arizona is so remote", is incorrect from a biological standpoint, as suitable habitat in California is within dispersal distance of the Mexican Wolf Experimental Population Area (MWEPA). If this statement is instead based on current regulations regarding recapture of wolves leaving portions of Arizona and New Mexico, then it may not be correct in the future given that those regulations are currently under revision.

The document should cite (4/46) recent research by the Wayne lab at UCLA (Hendricks et al. in prep.), which documented historic records of Mexican wolves in California, confirmed their identity as Mexican wolves via genetic analysis, and projected that suitable habitat was currently present in southeastern California. The status report is thus incorrect in stating (12/14-16) that such information does not currently exist. More generally, at (5/16) it would be relevant to cite and discuss evidence (e.g., 1) Leonard, J. A., C. Vilá , and R. K. Wayne. 2005. Legacy lost: genetic variability and population size of extirpated US grey wolves (Canis lupus). Molecular Ecology 14:9-17, 2) Vonholdt, B. M., J. P. Pollinger, D. A. Earl, J. C. Knowles, A. R. Boyko, H. Parker, E. Geffen, M. Pilot, W. Jedrzejewski, B. Jedrzejewska, V. Sidorovich, C. Greco, E. Randi, M. Musiani, R. Kays, C. D. Bustamante, E. A. Ostrander, J. Novembre, and R. K. Wayne. 2011. A genome-wide perspective on the evolutionary history of enigmatic wolf-like canids. Genome Research 21) of a regional gradient or cline in genetic identity of North American wolves rather than the hard subspecific boundaries hypothesized by previous taxonomic work.

Minor suggested edits

(12/12) No DPS is currently designated for the Mexican wolf subspecies. There is a proposal to list the subspecies “where found”, which would not involve a DPS designation.

(15/32-33) This sentence needs editing “In California, the habitat for enough ungulate prey to sustain a viable wolf population in California is in need of restoration to increase deer and elk populations.”

(6/10) It would be informative to show a map based on Newland and Stoyka 2013 (the information could be added to Figure 1).

(3/36) “feasible” is the wrong word here.

Key references on historic wolf distribution in California should be added:

Schmidt, R.H. 1991. Gray wolves in California: their presence and absence. California Fish and Game 77(2):79-85.

Shelton, S.L., and F.W. Weckerly. 2007. Inconsistencies in historical geographical range maps: the gray wolf as an example. California Fish and Game 93:224

Conclusion

In conclusion, it is laudable the CDFW recognizes (18/39-42) the need for proactive management through development of a wolf conservation and management plan. The status report, if revised based on peer review, can support this process. In contrast, the “not warranted” finding provisionally proposed by CDFW is not proactive, in that it fails to anticipate the likely continued dispersal of wolves into California from Oregon and the consequent need for protection of those individuals under CESA. As the report states (13/5), not all Oregon wolves are detected and collared. Therefore it is possible that

not all wolves dispersing to California have been detected. The fact that OR-7 is currently in Oregon (12/24-25) should not prevent consideration that other uncollared wolves may have already dispersed from Oregon to California or that OR-7 may again re-enter California. Basing status determinations on the temporary absence of individuals of the species from the state appears arbitrary. If the status review had been completed more rapidly, OR-7 would have still resided in California and the opposite conclusion would have been reached in regards to listing. Rather than using a dubious interpretation of CESA to decline to list species due to its temporary and uncertain absence from state, California should follow the example of Washington and Oregon in using the relevant state statutes to protect colonizing wolves while at the same time developing multi-stakeholder plans that proactively resolve wolf conservation and management issues.

Sincerely,

Carlos Carroll,
Klamath Center for Conservation Research,
e-mail: carlos@klamathconservation.org

Lee, Rhianna@Wildlife

Subject: FW: Gray Wolf Petition (California Endangered Species Act) - Status Review for California
Attachments: Gray Wolf Status Review Comment.docx

Importance: High

From: "Eisenberg, Cristina" <Cristina.Eisenberg@oregonstate.edu>
To: "Loft, Eric@Wildlife" <Eric.Loft@wildlife.ca.gov>
Subject: RE: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Dear Dr. Loft,

I have attached my peer review of the Status Review for California, in track changes on the document, plus a cover letter that summarizes my review of this document. Please let me know if you have any questions or if there is anything further way I can be of assistance.

All best,

Cristina Eisenberg, PhD
Oregon State University
College of Forestry
(406)270-5153

From: Loft, Eric@Wildlife [Eric.Loft@wildlife.ca.gov]
Sent: Thursday, November 21, 2013 10:42 AM
To: Eisenberg, Cristina
Subject: RE: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Hello—I realize how busy you must be, but I wanted to send a reminder that we would appreciate any review by tomorrow Nov 22. We will understand if your schedule does not allow time for this effort. Thanks in advance for your consideration-- Eric

From: Loft, Eric@Wildlife

Sent: Friday, October 18, 2013 12:11 PM
To: 'Eisenberg, Cristina'
Subject: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Dear Dr. Eisenberg,

Thanks for your tentative agreement to review the subject document attached here (WORD document plus PDF of appendix/figures). Please review the attached letter (PDF) describing our intent, purpose, and request of you as a reviewer. I understand that plans may change and you may not be able to review the document for us. If that is the case please let me know as soon as practical. Otherwise, thank you very much in advance for your expertise and insight regarding the document.

Please contact me by email or telephone if you have any questions/concerns about this effort.

Sincerely,

Eric

Eric R. Loft, Ph.D, Chief
Wildlife Branch
California Department of Fish and Wildlife
1812 Ninth Street, Sacramento, CA 95811
(916) 445-3555; eric.loft@wildlife.ca.gov<mailto:eric.loft@wildlife.ca.gov>
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From: Eisenberg, Cristina [mailto:Cristina.Eisenberg@oregonstate.edu]
Sent: Thursday, September 26, 2013 11:39 AM
To: Ed Bangs
Cc: rwayne@ucla.edu<mailto:rwayne@ucla.edu>; rabaldwin@ucanr.edu<mailto:rabaldwin@ucanr.edu>; Johnson, Douglas E.; swilson@bigsky.net<mailto:swilson@bigsky.net>; mechx002@umn.edu<mailto:mechx002@umn.edu>; npwrc@usgs.gov<mailto:npwrc@usgs.gov>; carlos@klamathconservation.org<mailto:carlos@klamathconservation.org>; Loft, Eric@Wildlife
Subject: RE: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Dear Dr. Loft,

I would be pleased to provide my scientific review of the California Department of Fish and Wildlife's status assessment on gray wolf in California.

All best,

Cristina Eisenberg, PhD
Oregon State University
College of Forestry
(406)270-5153

The Wolf's Tooth
Published in 2010 by Island Press
http://www.wolfstooth.com<http://www.wolfstooth.com/>
http://fes.forestry.oregonstate.edu/faculty/eisenberg-cristina

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College of Forestry
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cristina.eisenberg@oregonstate.edu
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November 21, 2013

Dr. Eric Loft
California Department of Fish and Wildlife
1812 Ninth Street
Sacramento, CA 95811

Re: Gray Wolf Department of Fish and Wildlife Peer Review Status Report
Comments regarding listing the gray wolf under the California Endangered Species Act

Dear Dr. Loft,

Thank you for inviting me to serve as a scientific peer reviewer for the California Department of Fish and Wildlife Draft Status Report of the gray wolf (*Canis lupus*). I have commented throughout the text of this draft status report. Below is a summary of my review.

In March, 2012, when the California Fish and Game Commission received the "Petition to List the Gray Wolf as Endangered," the wolf OR7 ranged in California. This wolf continued to reside in California, based on Argos collar data, through spring 2013. At the time this wolf was in the state, his presence provided sufficient information to warrant considering the above petition. Subsequently, OR7 left the state, changing the policy arena significantly. Consequently, I have based my review of the Status Report on the current status of OR7 (currently back in Oregon) and on the fact that no additional wolves have been confirmed in California.

The California Endangered Species Act (CESA) rationale and logic for listing a species based on the possibility of it "becoming extinct throughout all or a significant portion of its range in California," does not apply to a species that does not exist in the state. Further, while ample evidence exists of wolf presence in California historically, it is not possible to clearly define what "all or a significant portion of its range," might be with current data, including OR7's collar data. As such, I find that CESA's legal framework does not warrant listing this species at the current time.

In terms of CESA factors that may affect the ability of the gray wolf to survive and reproduce in the future, based on current science, I find that none (i.e., present or threatened habitat modification, overexploitation, predation, competition, disease, and other natural occurrences or human-related activities that could affect the species) present any threat to a species that has been identified as being among the most resilient mammals in North America (Weaver et al. 1996).

That said, I have concerns about the ability of the state of California to seek to "conserve self-sustaining populations of wolves in the State" (California Wolf Plan, under development),

without thorough consideration of the impacts of low wolf population levels outside of California post gray wolf federal delisting in the coterminous US (with the exception of the Mexican gray wolf—*C. baileyi*) (USFWS 2013). Any wolves becoming established in California will initially constitute a small population. Lacking a well-developed source population for dispersal, they may likely struggle to become self-sustaining, as has been the case with the Mexican gray wolf (Boyd and Pletscher 1999). Additionally, lack of consensus in the scientific community about wolf population dynamics post-delisting in the Northern Rocky Mountains indicates the need for a precautionary approach, if California has wolf conservation as its objective (Creel and Rotella 2012; Gude et al. 2011; Murray et al. 2010).

Finally, in order to address some of the issues that failing to list the gray wolf as endangered in California will raise in the conservation community, I suggest shifting the focus of the California Wolf Management Plan to a "California Wolf Recovery Plan". The Status Review Draft herein makes it clear that it's not "if" but a matter of "when" wolves recolonize California. Being as scientifically proactive about that eventual recolonization during the planning stages, including using language that emphasizes conservation, may help the state avoid litigation in general (Bangs et al. 2005).

When the next wolf becomes evident in California, I recommend revisiting a CESA listing, and seeing if such action is necessary, in concert with the Wolf Management Plan that is currently being drafted. Much depends on that plan.

Sincerely,

Cristina Eisenberg, PhD
Oregon State University

Literature Cited

Edward Bangs, et al. "Managing Wolf-Human Conflict in the Northwestern United States," in *People and Wildlife: Conflict or Coexistence,"* ed. Rosie Woodroffe, Simon Thirgood, and Alan Rabinowitz (Cambridge: Cambridge University Press, 2005), 340-56.

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S. Creel and J. Rotella. 2012. Meta-Analysis of relationships between human offtake, total mortality, and population dynamics of gray wolves (*Canis lupus*), PLoS One 5 (9): e12918.
Justin A. Gude et al. 2011. Wolf population dynamics in the US Northern Rocky Mountains are affected by recruitment and human-caused mortality. *Journal of Wildlife Management* 76: 108-118.

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STATE OF CALIFORNIA
NATURAL RESOURCES AGENCY
DEPARTMENT OF FISH AND WILDLIFE

REPORT TO THE FISH AND GAME COMMISSION

A STATUS REVIEW OF THE **GRAY WOLF** (*Canis lupus*) IN CALIFORNIA

Photo courtesy of ODFW

CHARLTON H. BONHAM, DIRECTOR
CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

October 2013 - PRELIMINARY DRAFT FOR REVIEW

Report to the Fish and Game Commission

A Status Review of the Gray Wolf in California

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Appendix A. California Historical and Current Wolf Records

Figure 1. Historical accounts of reported wolf observations, detections, or specimens in California. 2013.

Figure 2. Depiction of potential wolf habitat suitability in California from Oakleaf et al. (2006). Wolf OR7 locations were overlaid on the model output simply to illustrate where this individual dispersing wolf traveled, not for any validation purposes or testing of the model.

Figure 3. Depiction of the travels of gray wolf OR7 in California between December 2011 and March 2013. 2013.

Figure 4. Locations in Oregon of wolf packs and individual wolf OR7. http://www.dfw.state.or.us/Wolves/docs/Wolf_Use_Map_130719_0806.pdf. 2013.

Figure 5. Estimate of Deer, Elk, and Antelope Densities in California

Figure 6. Public and private ownership patterns in California. 2013.

EXECUTIVE SUMMARY

To be completed with final draft and will reflect the content of the Status Review

INTRODUCTION

Petition Evaluation Process

On March 12, 2012, the California Fish and Game Commission (Commission) received the "Petition to List the Gray Wolf (*Canis lupus*) as endangered under the California Endangered Species Act" (March 5, 2012; hereafter, the Petition), as submitted by the Center for Biological Diversity, Big Wildlife, the Environmental Protection Information Center, and the Klamath-Siskiyou Wildlands Center (collectively "Petitioners"). Commission staff transmitted the Petition to the Department of Fish and Wildlife (Department) pursuant to Fish and Game Code (FGC) section 2073 on March 13, 2012, and the Commission published formal notice of receipt of the Petition on April 13, 2012 (Cal. Reg. Notice Register 2012, No. 15-Z, p. 494). After evaluating the Petition and other relevant information the Department possessed or received, the Department determined that based on the information in the Petition, there was sufficient scientific information to indicate that the petitioned action may be warranted, and recommended the Commission accept the Petition (CDFG 2012). The Commission voted to accept the Petition and initiate this review of the species' status in California on October 3, 2012. Upon publication of the Commission's notice of determination, the gray wolf was designated a candidate species on November 2, 2012 (Cal. Reg. Notice Register 2012, No. 44-Z, p. 1610).

Comment [EC1]: I agree with this assessment. In April, 2012, OR7 was in the state of California. While this did not constitute a wolf "population," it constituted wolf presence.

Status Review Overview

Following the Commission's action designating the gray wolf as a candidate species, and as per FGC section 2074.4, the Department solicited information from agencies, educational institutions, and the public to inform the review of the species status using the best scientific information available. This report contains the results of the Department's status review, including independent peer review of the draft report by scientists with expertise relevant to the gray wolf.

While the Department believes sufficient scientific information exists to conclude that wolves occurred historically within California, it is unknown to what extent, as the species was extirpated from the state by the late 1920's. At the present time, no individual, pack, or population of gray wolf is known to occur in California. With the recent gray wolf expansion in the western United States, a lone gray wolf known as OR7 dispersed from Oregon's wolf population to California in December 2011 and is now back in Oregon (as of Fall 2013). It is feasible that gray wolves will eventually attempt to establish a breeding population in California in the foreseeable future.

There is no specific, biological/ecological data available on the gray wolf in California to inform decision-making, however, the Department believes there is relevant and applicable scientific information from elsewhere concerning wolf biology, ecology, populations, management, and

potential threats. Because of the differences in natural communities, management, and possibly other human-related factors between California and other western states and provinces, the degree of certainty to which information on wolf status and conservation from other locations can be used to predict a future status in California is unknown. The purpose of this status review is to fulfill the mandate as required by FGC 2074.6 and provide the Commission with the most current scientifically based information available on the gray wolf in California and to serve as the basis for the Department's recommendation to the Commission.

Comment [EC2]: This conclusion is very valid. Wolf recolonization elsewhere in North America has tended to follow similar trajectories, which render what we've learned in places like Oregon, for example, applicable to California.

Comment [EC3]: Unknown, but likely very relevant.

BIOLOGY AND ECOLOGY OF THE GRAY WOLF

Species Description

The gray wolf is the largest wild member of the dog family (*Canidae*). Depending upon subspecies, the range of sizes in both sexes is widely variable. Throughout their range, female adult gray wolves weigh from 40-120 pounds (18-55 kg), and measure from 4.5-6 feet (1.37-1.52 m) in total length. Adult males, which are generally slightly heavier and larger than females, vary in weight from 45-175 pounds (20-80 kg) and in total length from 5-6.5 feet (1.27-1.64 m). Shoulder height ranges from 27-32 inches (700-800 mm) (Mech 1974; Paradiso and Nowak 1982). Typical weights for adult female gray wolves in Montana are 80-100 pounds, and for adult males are 90-110 pounds (WDFW 2011).

Wolves are apex carnivores that prey on large herbivores such as elk, moose, bison, and deer. Because they occupy the top of the food chain, wolves can influence other species on all trophic levels from predators and prey to plants (USFWS 1987; Mech and Boitani 2003). Although mortalities to wolves have occurred from mountain lions, bears, from other wolves, and other large mammals, for the most part they do not have any natural predators (Mech 1970; Robbins et al. 2010). Wolves tend to select more vulnerable or less fit prey and are known to selectively hunt young or older animals, and those injured or diseased in greater proportion than healthy adult individuals (e.g., Mech 1970, Fritts and Mech 1981, Kunkel and Pletscher 1999; Stahler et al. 2006).

Systematics

Classification: The taxonomy of wolves in North America is complex, made more challenging by the fact that wolves were extirpated over large portions of their range prior to the earliest attempts to scientifically categorize the subspecies (Chambers et al. 2012). Due to a scarcity of verifiable samples, very little is known about which subspecies of wolf occurred in California. The first comprehensive review of North American subspecies of *C. lupus* identified three subspecies which historically may have occurred in California: the Cascades Mountains wolf (*C.l. fuscus*) in Northern California, the Southern Rocky Mountains wolf (*C.l. youngi*) in the Mojave Desert region, and the Mogollon Mountain wolf (C.*l. mogollonensis*) in the Colorado Desert region (Goldman 1944, Hall 1981). All three historical subspecies are now extinct. More recent revisions of North American wolf taxonomy by Nowak (1995, 2002, 2003) grouped the three historical California subspecies within the subspecies *C.l. nubilis*, the plains wolf. These revisions have recently been supported by Chambers et al. (2012). It is also possible that the Mexican wolf subspecies (*C.l. baileyi*), recognized under both the historical and contemporary classifications), particularly dispersing individuals, may have occasionally entered the extreme southeastern corner of California.

The most recent work suggests that the different North American subspecies are derived from three separate historical invasions of the continent by wolves from Eurasia, the first wave being ancestors of *C.l. baileyi*, the second wave ancestors of *C.l. nubilis*, and the most recent wave ancestors of *C.l. occidentalis* (Chambers et al. 2012). Chambers et al. (2012) found genetic and physiological differentiation between *C.l. nubilis* and *C.l. occidentalis* and supported Nowak's (1995, 2002) delineation of the separate subspecies. The genetic differentiation between *C.l. nubilis* and *C.l. occidentalis* indicates that each subspecies is more closely related to some European wolf subspecies than to each other.

The only wild wolf known to occupy California in recent times (OR7), entered California from an Oregon wolf pack. The Oregon wolf population was established from wolves emigrating from Idaho. The Idaho wolves originated from translocated wolves (*Canis lupus occidentalis*) captured in the Rocky Mountains of British Columbia and Alberta (Montana Fish, Wildlife, and Parks 2013). Wolves in certain Central Washington packs have been found to carry an admixture of both *C. l. occidentalis* and *C. l. nubilis* genes (Martorello 2013). Thus, the most recent wolf to occupy California, and the wolves most likely to colonize California in the future may be of a different subspecies than the wolves historically inhabiting the state. Information on wolf subspecies is presented for biological background. The Petition however, would apply to all *C. lupus* subspecies including the Mexican wolf.

Comment [EC4]: The rest of the logic for or against delisting has to do with OR7's presence or absence in California, which changes the policy arena significantly.

Life Span: Wolves reportedly live an average of 4-5 years in the wild (Mech 2006), although they can live up to 15 years (Ausband et al. 2009); and have been reported living longer in captivity.

Geographic Range and Distribution

Of relevance to California, the gray wolf currently inhabits the Northern Rocky Mountain States, Washington, and Oregon. This distribution is largely due to the efforts of the US Fish and Wildlife Service (USFWS) who drafted the Northern Rocky Mountain Wolf Recovery Plan in 1980 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 revised plan recommended recovery through natural re-colonization primarily from Canadian wolf populations. Reintroduction was recommended for Central Idaho if natural re-colonization did not result in at least two breeding pairs there within 5 years.

In 1982, wolves from Canada began to naturally occupy Glacier National Park in Northwestern Montana, and in 1986 the first litter was recorded. In 1995 and 1996, 66 gray wolves from Canada were introduced to Yellowstone National Park (31) and Central Idaho (35) as non-essential experimental populations (USFWS 2003), while the population in Northwestern Montana continued to increase naturally. 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 recent years, wolves have expanded into Washington and Oregon (CDFW 2011a).

Historical Perspective - California

The history of native California peoples suggests widespread distribution of knowledge and awareness of the wolf prior to European settlement. Of over 80 tribes that once existed, at least 15 were known to have separate words for wolf, coyote, and dog, and/or referenced the wolf in their stories, beliefs, and rituals (Geddes-Osborne and Margolin 2001, Newland and Stoyka 2013). This is consistent with the hypothesis that wolves were widely distributed in California.

There are numerous historical records of wolves in California, dating back to the 1700s. A number of the records from the early 1900s are from reputable sources: state and federal agency staff, biologists, and experienced backcountry travelers. The historical wolf records in California were summarized during the initial 90-day petition evaluation and these wolf occurrences are described in Appendix A. Some of the anecdotal observations are ambiguous as to whether the observer was reporting a wolf or a coyote, and until recently, only four physical specimens existed from California.

The Department was aware of four presumptive specimens housed in the Museum of Vertebrate Zoology at the University of California, Berkeley that were identified as wolves (i.e. *Canis lupus ssp*. (2), *Canis lupus fuscus*, and *Canis lupus youngi*). The Department, in collaboration with the UCLA Conservation Genetics Resource Center, sampled all four of these specimens. Preliminary results indicated that two of the specimens were wolves that may have occurred naturally in California (CDFW and Conservation Genetics Resource Center, unpubl. data).

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) also 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 the southwestern subspecies than the gray wolf to the north. Indeed the genetic work supports this conclusion as the results for this specimen has only been observed in historical and current captive sample of the Mexican wolf (*Canis lupus baileyi*) (CDFW and Conservation Genetics Resource Center, unpubl. data).

The second 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 56 pounds, it was estimated that in good condition it would have weighed approximately 85-90 pounds (Grinnell et al 1937). The preliminary analysis of this animal suggests that it represents a common *Canis lupus* origin (CDFW and Conservation Genetics Resource Center, unpubl. data).

Of the two other California specimens; one was determined to be a domestic dog (collected in 1982 Tehama County) and interestingly analysis on the other specimen (collected in 1962

Tulare County) indicated its genetic information had only been observed in modern far-north Alaska-Northwest Territories. Based in part on the collection date of 1962, it is speculated that this specimen was purposefully brought into California by humans (CDFW and Conservation Genetics Resource Center, unpubl. data).

While limited, the available information suggests that wolves were distributed widely in California, particularly in the Klamath-Cascade Mountains, North Coast Range, Modoc Plateau, Sierra Nevada, Sacramento Valley, and San Francisco Bay Area. While the majority of historical records are not verifiable, for the purposes of this status review, the Department concludes that the gray wolf likely occurred in much of the areas depicted (CDFW 2011a) (Figure 1). Still, it is not possible to assess the utility and accuracy of the recorded and ethno historical information in reconstructing a map of historical gray wolf distribution in California, and the true historical distribution remains uncertain.

Comment [EC5]: I agree with this conclusion, based on review of the evidence available. This then provides part of the logic for creating a California Wolf Plan

Historical Perspective – Oregon

The Department considers the range and distribution of gray wolves in Oregon to be relevant to California because Oregon is the most likely source for wolf dispersal into California. According to Bailey (1936), there were two native species of gray wolves in Oregon prior to being extirpated in the 1940s, *Canis lycaon nubilus* (east) and *C. l. gigas* (west), with ranges separated geographically east and west of the Cascade Mountains. *C.l. nubilus*, the species associated with the plains states, was called a variety of names including buffalo or plains wolf. *C.l. gigas* was known as the northwestern timber wolf, which was found along the Western Pacific Coast. Modern classification schemes do not recognize *C. l. gigas* as a subspecies and all wolves historically occupying Oregon would be classified as *C. l. nubilus* (Nowak 2002, Chambers et al. 2012).

Based on the historical information available for Oregon (Bailey 1936), it is possible that wolf distribution in Northern California would have been similar to that of the coastal and plains distribution found to the north, but the extent to which wolves ranged south into California is uncertain.

Reproduction and Development

In a healthy wolf population with abundant prey, a reproductive pair may produce pups every year. Females and males generally begin breeding as 2-year olds. Normally, only the dominant pair in a pack breeds, and packs typically produce one litter annually (Mech and Boitani 2003). The gestation period for wolves is 62-63 days. Most litters (1 to 11 pups) are born in early to mid-spring and average five pups. Pups are cared for by the entire pack, and on average four pups survive until winter (USFWS 2009).

Denning: 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 450 g (14.5 oz) (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 the young wolves are almost fully grown, they begin traveling with the adults.

Food Habits

Wolves are adapted to feeding on a diverse array of foods. As generalist carnivores, wolves can and do hunt prey that range in size from snowshoe hares (*Lepus americanus*) to bison (*Bison bison*), depending upon season and geographic location (Peterson and Ciucci 2003). In North America, wolves' winter diet is dominated by ungulates which are vulnerable to snow accumulation, and juveniles are the most common age class killed (Mech and Peterson 2003). In summer, North American wolves are able to consume a more diverse diet, and are often found to consume beavers, ground squirrels, coyotes, salmon, insects, and plant matter (Smith 1998; Peterson and Ciucci 2003; Darimont et al 2004), although ungulates represent most of the biomass consumed (Ballard et al 1987; Fuller 1989b).

Based on studies in Alberta, Canada, wolf predation on deer equaled that of elk (42% each); however, considering the biomass available to wolves, elk contributed 56% compared to 20% each for deer and moose (Weaver 1994). In British Columbia, black-tailed deer are the most common prey along coastal areas, and moose constitute much of wolf prey in the more southern areas (Darimont et al 2009; Mowat 2011). In the Northern and Central Rocky Mountains, elk are frequently the most important prey of wolves, but deer and moose comprise more in some areas (Huggard et al 1993; Boyd et al 1994; Mack and Laudon 1998; Arjo et al 2002; Husseman et al 2003; Kunkel et al 2004; Smith et al 2004; Atwood et al 2007). In areas where wolves and livestock co-occur, wolves have been known to kill and consume sheep, cattle, goats, horses, llamas, livestock guard dogs, and domestic pets (Bangs and Shivik 2001).

While OR7 was in California, he was observed pursuing a doe black-tailed deer. Based on evidence of known GPS locations (confirmed with wolf tracks and suspected wolf scat) it is believed that OR7 has fed on feral horse, bones at a livestock carcass pile, mule deer and mule deer fawns, and was suspected to have fed on ground squirrels. With the exception of the livestock carcass pile, it was not possible to determine if these food items were killed or scavenged (Kovacs 2013).

Wolf populations depend on the amount of prey biomass available (Packard and Mech 1980) and because prey abundance can vary from year-to-year, wolf population can also fluctuate (Fuller et al. 2003). Although mostly dominant when it comes to other predator species, competition for prey can occur with mountain lion, coyote, fox, and bear, as well as intraspecific competition with other wolf populations. The numerous mortality factors that prey species populations are subject to, such as starvation resulting from poor habitat conditions, winter kill, predation, road-kill, disease, and sport hunting also affect the amount of prey available to wolves.

Although a larger pack is more effective in capturing prey, this manner of hunting has been reported to result in less food per member. In contrast, when lone wolves and wolf pairs are able to capture prey, the amount of food obtained per wolf is greater when they are successful, although they are less successful each time they hunt (Fritts and Mech 1981; Ballard et al. 1987,

1997; Thurber and Peterson 1993; Hayes and Harestad 2000). Single wolves have been known to bring down an adult moose (Cowan 1947). However, the amount of food that can be utilized when a large prey animal is taken by one or two wolves is limited and without a sufficient number of feeders, this surplus can be lost to competitors, scavengers, insects, and bacteria (Mech and Boitani 2003), even when cached. Therefore, sharing the surplus of large prey with family members appears to be the most efficient approach adult wolves can take to enhance the survival of their offspring and their fitness (Mech 1970, 1991; Schmidt and Mech 1997).

As wolves occupy the role of apex predator, the ecosystem can be modified by influencing behavior, distribution and abundance of prey species, with subsequent indirect effects on habitat (USFWS 1987) and by influencing distribution and abundance of other predators (Levi and Wilmers 2012). Additionally, wolves influence ungulate population health and distribution (White et al. 2005, 2012; Smith 2012).

Territory/Home Range

Wolf packs live within territories they defend from other wolves. In areas with a well-established wolf population, a mosaic of territories develops. Packs compete with each other for space and food resources through widespread, regular travel, during which they scent-mark as a means of maintaining their territorial boundaries. Howling at specific locations serves to reinforce these scent-marks (Mech and Boitani 2003).

Territory size is a function of interdependent factors. Wolf pack size, prey size, prey biomass, prey vulnerability, and latitude are all factors that have been recognized as influencing the size of wolf territories. The smallest recorded territory was 13 square miles in northeastern Minnesota, defended by a pack of six wolves (Mech and Boitani 2003). The largest territory on record, defended by a pack of ten, was 2,450 square miles in Alaska (Burkholder 1959). Wolf territories in the northern Rocky Mountains typically range from 200-400 square miles (322-644 km^2) (USFWS 2003).

Wolf territories are known to shift seasonally due to changes in movements of ungulate species (Mech and Boitani 2003). In summer, the den is the social center with adults radiating out in foraging groups of various sizes (Murie 1944; Mech 1970). In winter, packs will sometimes split up to hunt in smaller groups, and pack members may lag behind to visit old kills or disperse temporarily (Mech 1966).

The two primary functions of wolf travel within the territory are foraging and territory maintenance (i.e., boundary maintenance via scent-marking), of which they apparently do both simultaneously (Mech and Boitani 2003). Wolves range over large areas to hunt and may cover 30 mi (48 km). or more in a day. The breeding pair is generally the lead hunters for the pack. 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). Within-territory movements differ between pup-rearing season and the rest of the year (Mech et al 1998). While pups are confined to the den or other rendezvous sites, movements of adults radiate out from and back to that core position (Murie 1944). Once pups are able to travel with the adults, movements become more nomadic throughout the territory (Burkholder 1959; Musiani et al 1998).

Rendezvous Sites: After the natal den is abandoned, wolves are known to use "rendezvous sites" as specific resting and gathering areas in summer and early fall, generally consisting of a meadow complex and stream, with an adjacent forest (Murie 1944; Carbyn 1974). Rendezvous sites where cover is sufficient are sometimes used for training and hiding pups, once they have reached an age where the den is no longer capable of containing them (Mech and Boitani 2003).

Dispersal: Some wolves remain with their natal packs for multiple years, but most eventually disperse. Dispersing wolves may conduct temporary forays, returning several times before finally dispersing permanently (Fritts and Mech 1981; Van Ballenberghe 1983; Gese and Mech 1991), while others disperse once, never to return (Mech 1987; Mech et al 1998).

A few differences have been detected between the sexes in terms of dispersal characteristics. In some areas or years, males may disperse farther than females (Pullainen 1965; Peterson et al 1984), but at other times or locations, females disperse farther (Fritts 1983; Ballard et al 1987), so the average dispersal distance is about the same for both sexes (Mech and Boitani 2003). Wolves disperse throughout the year; however fall and spring tend to be the peak periods. Dispersal primarily during these periods suggests that social competition may be a trigger. In the spring when pups are present, aggression from the breeding adults may occur (Rabb et al 1967; Zimen 1976), and in fall when pups are traveling with adults, food competition may be at its peak (Mech 1970; Mech and Boitani 2003).

The average dispersing distance of northern Rocky Mountain wolves is about 60 miles, although 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 (GPS) technology, exceeding 6,000 miles (USFWS et al 2011). In general younger wolves disperse farther than older wolves (Wydeven et al 1995). This is possibly explained by older dispersers having more familiarity with the local terrain, and hence perceiving greater opportunity locally, whereas younger, more naive dispersers wander farther seeking security in areas not already inhabited by hostile wolves (Mech and Boitani 2003). There is some evidence that when wolves do travel long distances, they move in a manner that seems goal-directed (Mech and Frenzel 1971). One explanation is that, unable to establish a territory locally, the animal is predisposed to travel in a certain direction for some particular distance or time before looking to settle (Mech and Boitani 2003).

In recent years, dispersing wolves from British Columbia, Montana, and likely Idaho have established packs in Washington, and dispersers from Idaho have established in Northeastern Oregon. The radio-collared male wolf OR7 dispersed into California in December, 2011 and remained in the state for over a year. OR7 returned to Oregon in March, 2013, and continues to remain in an area approximately 300 miles from any known wolf pack. Oregon Fish and Wildlife officials believe he is not accompanied by other wolves. As of the time that he left California, the Department estimated that he had traveled approximately 4,500 air miles.

Colonization: As wolves colonize or recolonize an area, the initial pack can proliferate quickly as conditions permit. This proliferation occurs in part through dispersal from the founding pack,

and in part from additional immigration (Mech and Boitani 2003). Wolves in newly colonized regions may shift their territories over large areas. In these newly colonized areas territories tend to be exclusive initially, but may overlap with other territories as the region becomes saturated (Hayes 1995). In general, as areas become saturated with wolf territories, the boundaries may shift but the cores tend to remain approximately the same (Mech and Boitani 2003).

Habitat Use

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 a number of variables, including availability and abundance of prey, availability of den sites, ease of travel, snow conditions, livestock density, road density, human presence, topography and continuous blocks of public lands. While suitable habitat generally consists of areas with adequate prey where the likelihood of human contact is relatively low (Mladenoff et al. 1999) wolves are highly adaptable and can occupy a range of habitats, however, human tolerance to the presence of wolves may be an important factor (Mech 2006).

Wolves require adequate space for denning sites located away from territory edges to minimize encounters with neighboring packs and avoid other potential disturbances while birthing and raising pups. Den site selection and preparation may occur as early as autumn (Thiel et al 1997), with non-breeding members of the pack participating in the digging of the den and providing other general provisions to the breeding female. Rendezvous sites where cover is sufficient are sometimes used for training and hiding pups once they have reached an age where the den is no longer capable of containing them (Mech and Boitani 2003).

Habitat Suitability Modeling: There are studies that have modeled potential suitable wolf habitat in California. Carroll (2001) modeled potential wolf occupancy in California using estimates of prey density, prey accessibility and security from human disturbance (road and human population density). Results suggested that areas located in the Modoc Plateau, Sierra Nevada, and the Northern Coastal Mountains could be potentially suitable habitat areas for wolves.

The Department has similarly developed a model in anticipation of a gray wolf conservation plan. Oakleaf et al. (2006) developed a model for the Northern Rocky Mountain (NRM) gray wolf Distinct Population Segment (DPS) and reported positive correlations with environmental factors (elk and forested habitats) and negative correlations between wolf occupancy and anthropogenic factors (human density and domestic sheep). The U.S. Fish and Wildlife Service developed a habitat suitability model for Idaho, which the Department modified for California based on the Oakleaf criteria; percent forest cover, human population density, elk density, and domestic sheep density. Currently, the Department believes that the Oakleaf model (subsequently validated in 2010 with respect to wolf survivorship) provides a rigorous approach and is based on fewer assumptions than other modeling efforts that have been conducted and which cover California (Figure 2).

CONSERVATION STATUS

In assessing conservation status for the gray wolf in California, the Department considers the status of the gray wolf in Oregon to be relevant, as wolves from Oregon would be the most likely source population in the future. Consequently, the status assessment as it relates specifically to animal population, trend, and distribution includes a brief overview of Oregon.

In regard to the Mexican wolf, the Department is of the understanding from both the U.S. Fish and Wildlife Service, and the Arizona Game and Fish Department, that the likelihood of wolves entering California from Arizona is so remote that the Fish and Wildlife Service did not include California as potential range in developing the recent Distinct Population Segment (DPS) for this subspecies. Because occurrence in California is so unlikely by the Mexican wolf, and the scientific information on wolf use of the deserts of Southern California is non-existent, the Department has concluded conducting a reasoned status evaluation for this animal is not feasible as it is for the gray wolf in northern California.

Comment [EC6]: Based on my review of Mexican gray wolf population dynamics, I agree that it is highly unlikely that a member of that population will disperse into California in the near future.

Trends in Current Distribution and Range

California: With no gray wolf population, there is no trend in distribution or range in California and it is not possible to assess a trend as there is no scientific data available for California. The only known natural occurrence of the gray wolf in California since extirpation has been OR7, the wolf that traveled south from Oregon (CDFW 2011b). The dispersal pattern of OR7 during his visits to California is provided but the Department does not consider the travels of this individual to constitute a geographic area of wolf range. At the time of this status review OR7 is in Southern Oregon (Figure 3).

Comment [EC7]: While it takes more individual to describe wolf range, other pioneering long-distance dispersals (e.g., Pluie from Kananaskis to Idaho, Montana, and BC in the early 1990s) in retrospect have done a very good job of demonstrating what potential habitat and geographic range for a new population might be.

Oregon: In 1999, dispersing wolves were first observed in Oregon. As the reintroduced Idaho wolf population expanded, increasing numbers of dispersing wolves eventually established packs in both Oregon and Washington by 2009. The range of the gray wolf in Oregon has been expanding since that time.

In 2010, there were two known packs; the Imnaha (OR7 pack of origin) and the Wenaha packs with 15 and 6 wolves, respectively. In 2011, three additional packs were known in Oregon; the Walla Walla, Snake River, and Umatilla River packs. In 2012, one more pack was established; the Minam pack. There is also another known pair located in that same general area, the Sled Springs pair that has an undetermined breeding status. In addition, there are at least three wolves are not associated with any pack (ODFW 2011), including OR7. As of June 2013, there are 6 established wolf packs in Oregon, all in the northeastern part of the state (Figure 4). Because of the growth in the Oregon wolf population, an expansion southward appears feasible in the foreseeable future.

Population Trend

California: There is no known population of gray wolf in California, therefore population estimate and trend information does not exist.

Comment [EC8]: This is valid. However, is all that can be done being done to monitor possible wolf presence in California?

Oregon: The current abundance of Oregon wolves through 2012 is estimated by ODFW to be a minimum of 46 animals. The Oregon wolf population has increased each year from 2009 through 2012, with the minimum number of wolves reported to be 14, 21, 29, and 46 animals, respectively (ODFW 2013a). The true number of wolves in Oregon was undoubtedly higher each year as not all wolves were likely detected. Whether this rate of increase will continue, or whether a similar rate of population growth could be expected to occur in California if a wolf pack(s) became established, is uncertain and is likely dependent on a number of factors, including habitat suitability and prey availability.

Habitat Essential for Continued Existence of the Species

Fish and Game Code section 2074.6 requires that a status review include preliminary identification of the habitat that may be essential to the continued existence of the species.

Wolves are wide ranging and can use varied habitats. Habitat used by wolves in other western states appear similar to California forest and rangeland habitats. These observations and an understanding of wolf life history, are considered relevant in developing a potential model of essential habitat for California. These factors contribute to the below discussion of potential, or possibly, essential habitat should a gray wolf population occur in California. Large, undeveloped tracts of public land provide suitable habitat and are generally required for the establishment of wolf populations in North America (Paquet and Carbyn 2003). It is believed these large tracts of undeveloped land reduce human access and thereby provide some level of protection for wolves (Mech 1995). However, as gray wolves expand their range in the U.S., they may increasingly inhabit areas near 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.

However, as no gray wolves are known to inhabit California, habitat essential for the *continued existence* of wolves is not presently at issue. Additionally, as no scientific data on habitat selection or preferences of gray wolf in California exists, it is not possible to describe essential habitat with certainty.

Comment [EC9]: I disagree with this assessment. Given what we know about wolf habitat via HSI analyses, etc., I think we can predict with some certainty what essential habitat for wolves would be in California. OR7's movements, which only constitute an *n* of 1, provide some information that can be used to test models, but much more is needed.

Factors Affecting Ability of the Gray Wolf to Survive and Reproduce

Degree and Immediacy of Threats: As far as the Department is aware, the gray wolf does not presently (September 2013) inhabit California. Consequently, there is no immediate threat to gray wolf survival and reproduction in California. However, due to the potential for wolves to become established in the future, the following factors may become relevant. Unless, and until, the gray wolf becomes established in California and first-hand scientific information becomes available, there is uncertainty in predicting the potential significance of these factors under California conditions.

Comment [EC10]: I agree with this assessment.

Human Predation on Wolves: Fear of wolves has been passed down from generation to generation for centuries, partially due to danger that large predators pose to humans. A factor contributing to the legacy of fear is that historically, prior to modern medicine, bites by rabid wolves almost always resulted in death. Cases of "furious" wolf attacks have been documented with one wolf sometimes biting large numbers of people (Linnel et al. 2002).

Negative human attitudes toward wolves are largely based on a perceived threat to personal safety or livelihood. Early settlers and explorers viewed wolves and other large predators as a serious threat due to direct losses of livestock, but also as competitors with humans for the large ungulates which early settlers relied on in part for food. Wolves, grizzly and black bears, and mountain lions were actively killed as settlers moved west and were removed from most of the lower U.S. to allow a safe environment for the establishment of farms and ranches throughout the west. While nationwide, the overall loss of cattle due to wildlife is about 5.6 percent (219,900 cattle lost), wolves contributed 0.2 percent (8,100 cattle lost) of the total reported losses (3,992,900 total cattle lost). More than half of all predator losses are caused by coyotes (USDA 2011). However, public perceptions of wolves attacking people and the losses of livestock, continues to influence human attitudes toward wolves. Studies focused on the attitudes of people toward wolves as wolves have been reintroduced in the U.S. have shown a trend of increasing tolerance in some areas (Bruskotter et al. 2007), and a decreasing tolerance in others (Chavez et al. 2005).

Negative attitudes toward wolves would still likely be in place in California if the species establishes itself. However, development of sound management and conservation strategies involving California's diverse stakeholders, and communicating those strategies to the public may reduce the potential for this to be a threat by increasing human tolerance for wolves in the state.

Damage Control: The conflict between wolves and livestock producers, and the resultant take of wolves under depredation/damage control, constitutes a threat to individual wolves at a minimum and may represent a potential threat in California if the gray wolf populations were to become established in the state. Washington and Oregon have criteria to determine if wolves have become habituated to killing domestic animals and has steps to remove them, as necessary (ODFW 2012, WDFW 2012). However, the wolf populations in the Northern Rocky Mountains, and in Washington and Oregon, are continuing to increase in the presence of this threat suggesting that it is not likely a significant issue to maintaining wolf populations in these states.

Other Human Influences: Human take of wolves is the primary factor that can significantly affect wolf populations (USFWS 2000, Mitchell et al. 2008, Murray et al. 2010, Smith et al. 2010). Thus, conservation and recovery efforts for the wolf have been successful to a substantial extent by limiting human-caused wolf mortality and allowing populations to recolonize in several states. In recent years, public hunting of the gray wolf has been initiated in some states (such as Idaho and Montana) for species management purposes, resulting in substantial harvest of wolves, however, the long-term effects on the species population dynamics are not yet known.

Comment [EC11]: If wolves are delisted throughout the coterminous US, with the exception of the Mexican gray wolf, then wolf numbers may be kept sufficiently low by states that have established wolf populations to depress dispersal probability. Still, if Oregon adheres to its state wolf plan post recovery of this species, then that may be sufficient to maintain a modestlevel of wolf dispersals into California.

Human population growth and increased human use of open spaces through urban and residential development, natural resource utilization (i.e., timber, mining, water use, agriculture, etc.), and increased access to public lands for human recreation all have the potential to impact habitat for wolves and influence the ability for populations to become established and sustainable over time (Carroll 2001, USFWS 2013). Other potential impacts to

wolves could occur from disease, vehicle strikes, urban growth, road development, highways (which pose barriers to wolf movements), dams, habitat loss and other development.

Prey Availability

In most northwestern states, elk and moose are the primary prey species for wolves (USFWS 1987). In Oregon and in the Great Lakes area, wolves prey on deer more when larger ungulate species are unavailable (ODFW 2010; USFWS 1987). In California, wolves would be expected to rely heavily on deer because elk population numbers are far fewer across the landscape. Wolves will take smaller prey or scavenge when necessary, but tend to prefer hunting larger ungulates (CDFW 2011a).

In California, it is unknown whether the available habitat supports or is capable of supporting, adequate numbers of the primary prey species, elk and deer, to sustain a wolf population combined with the other factors affecting these species. In northern California, where the gray wolf would likely first colonize, the current elk population is estimated to be approximately 7,000 animals across approximately 28,000 sq miles of wildland in the eight northern counties, and occurs at low densities except in the coastal zone (Figure 5). California's mule deer populations have been in a slow and steady decline since they peaked in the 1960's, and are down an estimated 50-70 percent in the northern counties where the habitat would otherwise appear to be potentially suitable for gray wolf. Additionally, California's other predators on deer and elk, specifically mountain lion, bobcat, coyote, and black bear, are considered common species and black bear have been increasing in population since the 1980s. The mountain lion (estimated population of 4,000-6,000 statewide based on a 1970s estimate) is a specially protected mammal for which no hunting can occur. The black bear population in California has approximately tripled in the past 25 years to over an estimated 30,000 animals statewide, with fewer than 2,000 typically harvested annually through hunting in most years (http://www.dfg.ca.gov/wildlife/hunting/bear/docs/2011BearTakeReport.pdf). These species would compete with the gray wolves for food. It is unclear what effect the presence of wolves in the state would have on the populations of black bears and mountain lions, although competition for resources would be expected to reduce the populations of these competing predators and the proportion of game animals taken by each of them might likely change. In California, the habitat for enough ungulate prey to sustain a viable wolf population in California is in need of restoration to increase deer and elk populations.

Comment [EC12]: This piece is important in preparing the ground for future wolf recolonization in California.

Habitat suitability models for the gray wolf (Carroll et al. 2001, Oakleaf et al. 2006, CDFW in prep.) take into consideration the estimated abundance of elk prey, but not deer prey. The Department is gathering information to adapt the Oakleaf et al. (2006) model to reflect our current information on the distribution and density of large ungulate prey in California (essentially combining Figure 2 and Figure 5). Until wolves attempt to enter and become established in California, it is not possible to determine with certainty whether a population can be sustained by the existing prey available in the state.

Comment [EC13]: I think that the current ungulate population in California is more than sufficient to sustain a wolf population such as Oregon had as of mid-2013 (~49 wolves). The forthcoming book by Mech and Smith on wolf predation may shed further light into such matters.

Competition

Competition for resources (e.g. food, space) occurs between wolves and other predators. Mountain lion, black bear, coyote, bobcat, and fox species are carnivorous animals that would likely be the most affected by wolves becoming established in California. It is unknown what

the interspecific relationships among the gray wolf and other predators would be, in particular for species that have unusual status already in California (the Sierra Nevada red fox is threatened under the California Endangered Species Act and the mountain lion is a "specially protected mammal" per legislation). Mountain lions are a common predator in California's deer ranges and are protected from take or harvest through legislation. It is likely that the mountain lion would be the primary competitor with wolves for deer. In Yellowstone National Park, as wolf numbers increased, mountain lions shifted to higher elevations and more north-facing slopes in the summer and in more rugged areas in the winter (Bartnick et al. 2013). Home ranges for wolves and mountain lions overlapped, but mountain lions avoided areas recently occupied by wolves (Kortello 2007). Whether these patterns would hold in California is uncertain as the habitats, weather, and prey base including ungulate migration patterns are different. No scientific information available to the Department suggests that competition with other predators is likely to pose a significant threat to wolves in California.

Comment [EC14]: I agree with this assessment.

Black bears, another potential predator in California, are known to coexist with gray wolves although conflicts around wolf dens, bear dens, or food have resulted in either species being killed. Generally, adult bears are rarely killed by wolves but injured, young, or old bears have been known to be prey in some circumstances (Murie 1944, Ballard 1982, Paquet and Carbyn 1986, Koene et al. 2002). Black bears can also have impacts to ungulate populations and are known to hunt and kill the fawns of elk and deer to the point of having a substantial impact to the young-of-the-year in a given region (Rogers et al. 1990, White et al. 2010).

Small Population Size

Comment [EC15]: This could provide a threat to future California wolves, depending on how wolves are managed outside the state post federal delisting in the 498 coterminous US.

The threats inherent to small, isolated populations would apply to any wolf or initial wolf population that may attempt to colonize California. A small wolf population would likely be less able to withstand and rebound from natural and human influenced causes of mortality . A small population size increases the risk of extirpation through demographic, environmental, and random genetic changes over time, particularly if the population is isolated; as well as through deleterious effects associated with low genetic diversity (Traill et al. 2007, Traill et al. 2010). The degree to which colonizing wolves are able to breed with and exchange individuals between packs in Oregon or other neighboring states will influence the significance of the threat posed by small population size.

The growth of wolf populations in and around the northern Rocky Mountains since 1995 provides evidence that the gray wolf, with appropriate conservation actions, can apparently overcome the threats associated with a small population size.

Comment [EC16]: This logic is faulty. This population growth had much to do with the fact that wolves were strictly protected. Even pre-delisting in Montana, the wolf population in Yellowstone reached an asymptote. In nature's economy what goes up must go down, or at least level off. The wolf "boom" outside of California may be over in most places, so a deeper analysis of wolf population trends post delisting in the NRM, and associated with delisting throughout the US is called for to better be able to answer questions about the effect of a small population size.

Climate Change

Climate change potentially offers both benefits and challenges for a future gray wolf population in California. Many prey and predator species have shifted their distributions towards higher latitudes and elevations due to climate change (Thomas 2010; Chen et al. 2011). It is predicted that temperature will increase and precipitation will decrease in California in coming decades (Van den Hurk et al. 2006; Cayan et al. 2012). Top consumer species at higher trophic levels have greater metabolic needs and smaller population sizes than those at lower trophic levels (Voigt et al. 2003; Vasseur and McCann 2005), which makes them more sensitive to climate change (Gilman et al. 2010). Other climate change predictions may influence the habitat's

ability to sustain wolf populations in California. For example, reduced forest vegetation in the Sierra Nevada and Cascade Mountains (Lenihan et al. 2008) due to increased temperatures and catastrophic fires (Fried et al. 2004) could limit suitable habitats for wolves, especially in terms of denning and cover requirements. Conversely, with increased wildfire in forest communities, early successional habitats that result would likely provide benefits to large herbivore prey species. Consequently, it is unknown what affect climate change will have on wolf and prey populations or distributions in California.

Comment [EC17]: Likely minimal, wolves are among the most resilient species known, see Weaver et al. 1996. Resilience and Conservation of Large Carnivores in the Rocky Mountains. *Conservation Biology* 10 (4): 964-976.

Diseases

Wolves are vulnerable to a number of diseases and parasites, including, mange, mites, ticks, fleas, roundworm, tape worm, flatworm, distemper, cataracts, arthritis, cancer, rickets, pneumonia, and Lyme disease. In colder northern regions, external parasites tend to be less of a problem (Idaho DFG 2013). Whether these diseases and parasites have, or would have, substantial impact on a gray wolf population in California is unknown. The primary known diseases and parasites are described below.

Canine distemper and canine infectious hepatitis: Both diseases are known to occur in wolves and more recently canine parvovirus has become prevalent in several wolf populations (Brand et al. 1995).

Mange: Mange consists of tiny mites that attach themselves to a wolf's fur or skin. In sarcoptic mange, intense itching occurs due to female mites' burrowing under the wolf's skin to lay eggs. In demodectic mange, the mites live in the pores of the skin and cause little or no itching. The symptoms of mange include skin lesions, crusting, and fur loss. Wolves that suffer mange in the winter lose fur that protects them resulting in hypothermia and possibly can cause them to freeze to death.

Canine Distemper: Canine distemper is a very contagious disease caused by a virus. The disease is often centers on the skin, eye membranes, and intestinal tract, and occasionally the brain. Symptoms include fever, loss of appetite, and a discharge from the eyes and nose. Diarrhea and dehydration may follow and in final stages seizures may occur (Brand et al. 1995). Canine distemper can result in periodic population declines in wild wolves (Almberg et al. 2010, Almberg et al. 2011)

Canine Parvovirus: The transmission of disease from domestic dogs, e.g. parvovirus, is a grave conservation concern for recovering wolf populations (Paquet and Carbyn 2003, (Smith and Almberg 2007). Recently, two wolves and two pups in Oregon were found to have died from parvovirus (ODFW 2013b). The disease is not thought to significantly impact large wolf populations, but it may hinder the recovery of small populations (Mech and Goyal 1993). It is currently unknown how much this disease may affect Oregon wolf populations or potential future California populations.

Canine Adenovirus (Hepatitis): Infectious canine hepatitis (ICH) is a contagious disease of dogs that can effect wolves, coyotes, foxes, bears, lynx and other carnivores with signs that vary from no visual signs to a slight fever and congestion of the mucous membranes to severe

depression, marked low white blood cell count, and blood clotting disorders. Although controlled by immunization in domestic animals, periodic outbreaks, which may reflect maintenance of the disease in wild and feral hosts, reinforce the need for continued vaccination of domestic pets (Merck 2013).

Rabies: Contrary to popular myth, rabies is very rare in wolves. Although rabies is fatal to wolves and has been detected in wild wolves in North America, the disease is not thought to be a major factor in the population ecology of wolves (Theberge et al. 1994).

Parasites: Roundworm, tape worm, flatworm, mange, mites, ticks, and fleas. *Echinococcus granulosus (E. granulosus):* is a very small (3-5mm) tapeworm that requires two different animal species, a canid and an ungulate, to complete its lifecycle and is already naturalized in CA (Idaho DFG 2013). It is not known to what extent these parasites may pose a threat to a future wolf population in California.

Other Risk Factors

Overexploitation: The possibility of future increased access to areas that are currently roadless, for resource extraction (logging, mining, etc.) or high-impact recreational activities (off-road vehicles, winter snowmobiling, etc.) could impact a future gray wolf population. However, given such activities are not substantially proposed in northern California, we do not consider them a potential risk factor under current public land management strategies. Other recreational activities (hiking, photography) could disturb wolves if they occur at sensitive times or in a manner that is especially disruptive if of long duration or high intensity. Poaching has the potential to impact wolf populations by affecting prey populations, or by the direct killing of wolves. The significance of these potential threats is unknown and would be difficult to quantify.

EXISTING MANAGEMENT, MONITORING, AND RESEARCH ACTIVITIES

Wolf Conservation and Management Strategies in California

Prior to OR7 arriving in California, the Department began developing background information in anticipation of such an event. A wolf planning document, Gray Wolves in California (CDFW 2011a), was completed that outlined basic information about the history, current conditions, potential for natural re-colonization and management implications. Once OR7 was in the state, the Department quickly worked with the USFWS and the USDA Wildlife Services to develop an interagency coordination plan to respond to events involving a wolf as needed (USFWS/APHIS/CDFW 2012).

At the time of this status review, the Department is working on a wolf plan for California. The primary goal of this plan is to develop a strategy for the long-term conservation and management of wolves in the state. The plan is on a schedule to be approved and in place by early 2015. The Department recognized the need to be proactive in developing a strategy for coordination with federal partners and to be responsive to the questions and concerns by a variety of stakeholder groups. A part of that preparation will require more detailed assessments of potential habitat capability in California. Additionally, the Department's deer and elk

Comment [EC18]: Much depends on this plan. I suggest changing its title from a "Wolf Management Plan," to "Wolf Recovery Plan," given as is expressed in this review, the strong likelihood of wolves recolonizing the state from Oregon.

programs are working toward development of more comprehensive assessments of prey species given the potential for the gray wolf to become established in California.

Monitoring

Coordination with the Oregon Department of Fish and Wildlife and the USFWS will continue in the effort of tracking radio and GPS collared wolves from Oregon packs. Additionally, general wildlife surveys that occur along the Northern California border will continue annually to monitor for a number of wildlife species, including wolves when yearly assessment work occurs in areas that might potentially detect dispersing wolves from Oregon. It is anticipated that monitoring will be considered as part of the wolf plan that is in the beginning stages of development by the Department.

Current Land Management Practices

The following land management summary applies to forests and ranges of California that could potentially be inhabited by gray wolf in the future. To the Department's knowledge, none of the current land management planning efforts being implemented have specific objectives, prescriptions, or actions related to the gray wolf.

Land management practices in California in areas of potential wolf habitat vary with ownership. Large areas of mid-elevation forest and meadow vegetation communities with low human density are the primary criteria used to estimate potential wolf management areas, although wolves can sustain a population in a variety of different habitat types. Fifty five percent (55%) of the forest land in California is publicly owned, the vast majority of which is owned and managed by the federal government (CDF 2010). The remaining 45% is privately owned. Most of the federal forest land in California is owned and managed by the United States Department of Agriculture Forest Service (USFS). The USFS manages 4,355,231 ha (10,762,000 ac) of conifer forest land in California (CDF 2010). The National Park Service (NPS) is another significant landowner in the species' potential California range, owning and managing 447,583 ha (1,106,000 ac) of conifer forest land (Ibid.). Although some potential habitat is owned and managed by California State Parks, the California Department of Forestry and Fire Protection, and other public agencies, most of the 2,692,376 ha (6,653,000 ac) of non-federal conifer forest land is privately owned (Ibid., Figure 6).

U.S. Forest Service Management: Land management on USFS lands is governed by the Land Resources Management Plan (LRMP) of each National Forest. The LRMPs of the Sierra Nevada National Forests were amended by the 2004 Sierra Nevada Forest Plan Amendment (SNFPA) which specifies that vegetation management strategies should be "aggressive enough to reduce the risk of wildfire to communities in the urban-wildland interface while modifying fire behavior over the broader landscape" (USDA Forest Service 2004).

On USFS lands, decisions about management actions are made giving consideration to the conservation of natural resources, restoration of ecological health, the protection of communities, as well as other considerations. Resource and ecological health considerations include conservation of the forest habitats utilized by the California spotted owl (*Strix occidentalis occidentalis*), northern goshawk (*Accipiter gentilis*), fisher (*Martes pennanti*), and

American marten (*Martes americanus*) (USDA Forest Service 2004). Additionally, forest managers assess potential impacts and long-term effects management actions may have on Management Indicator Species (MIS), species identified to represent the health of the various habitats managed in each forest. These species evaluations are done at the local level and at the bioregional scale, which analyze impacts related to information from population monitoring data and/or habitat trends of each potential effected MIS, as identified in each forest. The land management decisions on National Forest lands with the greatest potential to influence future wolf populations are those related to the elimination of early seral forest habitats, fire suppression, catastrophic wild fire, public access, livestock grazing, and road construction.

Comment [EC19]: Accurate assessment of the situation, as with BLM lands.

Bureau of Land Management: BLM rangelands are interspersed all through northern California, and provide valuable range for elk and deer. BLM lands are managed for multiple uses and livestock grazing occurs throughout areas potentially inhabitable by the gray wolf. Additionally, in the northeastern part of California, wild horses are common and could potentially be preyed upon by wolves. As with National Forest lands, the management decisions with the greatest potential to influence a future wolf population are related to the elimination of early seral forest habitat types, fire suppression, catastrophic wild fire, livestock grazing, and public access.

National Park Service Management: There are a number of large, continuous areas of National Park Service lands with potentially suitable wolf habitat in California. Forest lands within the national parks and monument are not managed for timber production. The National Park Service preserves the natural and cultural resources found in each unique park setting. As with National Forest lands, the management decisions with the greatest potential to influence a future wolf population are related to public access.

State and Private Lands: Forest management on state and private conifer forest lands in California is regulated by the California Forest Practice Rules (FPRs) (Title 14, California Code of Regulations, chapters 4, 4.5, and 10) which implement the Z'berg-Nejedly Forest Practice Act. The FPRs require Registered Professional Foresters to prepare Timber Harvesting Plans (THPs), or similar documents (e.g. NTMPs) prior to harvesting trees on California timberlands. The preparation and approval of THPs is intended to ensure that potentially significant impacts to the environment are considered and, when feasible mitigated. Large blocks of contiguous industrial forest lands; particularly those with restricted public access, would be expected to be high quality wolf habitat should wolves become established in California. Public access policies vary by landowner and location.

Non-timber projects on state and private lands which are funded or authorized by public agencies are subject to the provisions of CEQA (e.g., highway construction, residential and commercial development, some energy projects). CEQA requires that actions which may substantially reduce the habitat, decrease the number, or restrict the range of any species which can be considered rare, threatened, or endangered (regardless of status under state or federal law) must be identified, disclosed, considered, and mitigated or justified (California Code of Regulations, Title 14, sections 15065(1), 15380). However, like the FPRs, there are no established guidelines or minimum conservation measures related to species impacts or their mitigation measures.

Sensitive Species Designations

State, federal and non-governmental organizations designate "at risk" species (e.g., threatened and endangered species, California Species of Special Concern, Species of Greatest Conservation Need) and assess and rank their conservation needs. Status designations for the gray wolf are summarized below for California, Oregon, and Nationwide (Federal):

State of California Status: The Fish and Game Commission designated the gray wolf as a "candidate" for listing as endangered or threatened under the California Endangered Species Act (CESA), effective November 2, 2012 (Cal. Reg. Notice Register 2012, No. 44-Z, p. 1610). Should the species not be listed under CESA, existing statutes classify the wolf as a nongame mammal (California Fish and Game Code section 4152) and subject to regulation under the authority of the Commission. Additionally, California law regulates the import and possession of wolves (CFGC section 2150, 2157, 6530, and California Code of Regulations Title 14, section 670). Because of its current federal listing status (see below), any gray wolves entering into California are considered a federally listed endangered species.

State of Oregon Status: Gray wolves are listed statewide as endangered in Oregon under the state's Endangered Species Act and protected under the Federal ESA in Western Oregon.

Federal Status: The gray wolf is currently listed as endangered throughout portions of its historic range, including California, under the Federal Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*)(ESA) wherever it has not recovered or has been determined to be an experimental population. However, the USFWS is currently in a public comment period through October 28 to consider their proposed rule to remove the gray wolf from the list of threatenede and endangered species, while explicitly identifying the Mexican wolf as an endangered species.

Comment [EC20]: Given this pending action, a more conservative wolf management plan for California is warranted, if the state wants to conserve wolves in the state whenever they recolonize California.

The Northern Rocky Mountains (NRM) gray wolf DPS was recently delisted in Montana, Idaho, Eastern Oregon, Eastern Washington, and North Central Utah due to meeting the recovery criteria of the NRM wolf recovery plan. Wolves that enter into California, and the western side of Oregon and Washington, are still protected by the ESA, which is administered and enforced by the USFWS. Under the ESA, the USFWS has lead responsibility for wolves in California. The Great Lakes gray wolf DPS has also been recovered and is currently delisted.

For species listed as endangered under the Federal ESA, activities that may result in "take" of the species are prohibited. The ESA defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."

MANAGEMENT RECOMMENDATIONS

The Department provides the recommendations below pursuant to FGC Section 2074.6 that directs the Department to include recommendations for management activities and other recommendations to aid in recovery of the species. However, the Department is currently leading the development of a California Wolf Plan, projected for completion in early 2015. This document will provide a comprehensive strategy for management of wolves in California for the future. Even though there currently are no wolves in California, the Department believes the following recommendations highlight actions that could help to conserve and manage gray

wolves in California if they become established in the state. Recommendations are based on scientific information on the gray wolf and are consistent with the possibility that wolves could enter and become established in California in the foreseeable future. These are preliminary recommendations based on information developed by Oregon, Washington, and USFWS for the NRM DPS. As new information becomes available, recommendations will be further refined. The recommendations are:

- Communicate to the public that natural dispersal of wolves into California is reasonable foreseeable given the expanding populations in the Pacific Northwest. Inform the public with science-based information on gray wolves and the conservation and management needs for wolves in California, as well as the effects of having wolves in the State.
- If and when wolves establish in California, seek to conserve self-sustaining populations of wolves in the State
- Manage native ungulate populations in the State to provide abundant prey for wolves and other predators, intrinsic enjoyment by the public and harvest opportunities for hunters
- Manage the distribution of wolves within the State where there is adequate habitat
- Prevent the construction of, or eliminate, barriers that would restrict the movement of wolves or their prey in California.
- Implement large scale restoration and enhancement projects that would improve habitat quality and carrying capacity of native ungulates, primarily elk and deer.
- Develop management strategies to minimize wolf-livestock conflicts
- Develop an education and outreach plan to promote public understanding of wolves and wolf conservation. Present key facts on public safety, livestock depredation, and emerging wolf science. .
- Prioritize projects that conserve large tracts of land consisting of continuous, diverse forest habitats throughout Northern and Northeastern California.

Comment [EC21]: Mexican gray wolf population dynamics suggest that without a strong source population sending dispersers into California, wolves in California will face challenges in becoming "self-sustaining."

SCIENTIFIC DETERMINATIONS REGARDING THE STATUS OF THE GRAY WOLF IN CALIFORNIA

California law directs the Department to prepare this report regarding the status of the gray wolf in California based upon the best scientific information. Under the pertinent regulation, a "species shall be listed as endangered or threatened ... if the Commission determines that its continued existence is in serious danger or is threatened by any one or any combination of the following factors: (1) present or threatened modification or destruction of its habitat; (2) overexploitation; (3) predation; (4) competition; (5) disease; or (6) other natural occurrences or human-related activities." (Cal. Code Regs., tit. 14, § 670.1, subd. (i)(1)(A).)

Also key from a scientific standpoint are the definitions of endangered and threatened species, respectively, in the Fish and Game Code. An endangered species under CESA is one "which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, over exploitation, predation, competition, or disease." (Fish & G. Code, § 2062.) A threatened species under CESA is one "that, although not presently threatened with extinction, is likely to become an endangered

species in the foreseeable future in the absence of special protection and management efforts required by [CESA]" (*Id.*, § 2067).

The Department's scientific determinations regarding these factors as informed by, and following, independent peer review are summarized below. Because there is no current known population of gray wolves, or at the time of this status review, even a single known gray wolf in California, and because there is very little scientific knowledge available regarding historical populations that may have occurred in the state, all threats discussed are considered potential in nature. While the Department is identifying these factors, the actual significance of each as a real threat cannot be determined at this time.

1) Present or Threatened Modification or Destruction of Habitat
   - Modification or destruction of suitable denning and foraging habitat by human development (e.g. logging, or mining activities).
   - Increased human access and fragmentation of suitable habitat from new road construction.
   - Modification or loss of suitable denning and foraging habitat, and associated prey species from wildfire.
   - Native ungulate habitat reduction in habitat quality and quantity due to non-native plant species, competition with other herbivores (wild horses, domestic livestock), fire suppression, catastrophic wild fires, broadscale herbicide application for conifer release, loss of early seral forest habitat conditions due to absence of natural disturbances (natural fire regimes, promotion of late seral forest types)

2) Overexploitation
   - Threat of unnecessary human exploitation of wolves due to fear for personal safety.
   - Threat of human exploitation of wolves due to fear, or of loss of personal property (such as pets/livestock) or poaching.
   - Disturbance from ecotourism and other recreation in wolf denning and foraging habitats.

3) Predation
   - Predation on wolves by other wildlife species would not be expected to be a significant factor influencing wolves California.

4) Competition
   - Competition with mountain lions, bobcats, black bears, and coyotes influencing prey availability and distribution.
   - Harvest of elk and deer through sport hunting.

5) Disease
   - Risk to colonizing populations due to a zoonotic disease event (e.g., rabies, parvovirus, canine distemper).
   - Risk of the transfer of diseases between domestic animals and wolves.

6) Other Natural Occurrences or Human-related Activities

- Risk of mortality due to roads, highways and expressways.
- Dispersal barriers to movement, genetic exchange, pair establishment, and territory occupancy.
- Risks inherent to small populations.

The Department is not applying these potential threats to make any inferences toward the gray wolf (Mexican wolf) that occurs in the Southwest. Because the likelihood of this animal inhabiting California is so remote, the Department's only finding is that there is no scientific information to support a status review.

Comment [EC22]: See comment above regarding need for a solid source population. Lacking such a robust source population, a California wolf population will struggle.

Summary of Key Findings

Under the protections afforded by the Federal Endangered Species Act and the reintroduction recovery efforts since 1994, wolves are recolonizing portions of their historical range. The population has recovered in the Northern Rocky Mountains and has provided a source population for the edges of their range that is now being repopulated. Washington and Oregon have newly established populations that are expanding rapidly and making progress toward recovery goals. Oregon wolf recovery and management strategies describe population establishment statewide, and in time, establishment of wolves in California is considered possible. The habitat and prey base in California may be able to support a wolf population, based on habitat similarities with Oregon and the species' demonstrated adaptability for using a variety of habitats and prey species, but this remains uncertain, particularly with lower elk and deer densities in California. There currently is no wolf population in California for which to assess range, abundance, population trend, suitable habitat, or the potential threats.

Wolves are adaptive in prey selection and can occupy a variety of habitat types as long as they can find remote areas to reproduce without human disturbance. Although wolves prefer elk when available, they will opportunistically take other large ungulates, other carnivore species, or smaller prey. The number of wolves that could ultimately be supported in California is unknown, as would be their impact on the prey populations and other wildlife species in California's ecosystems. Given the current expansion of wolves, and the growth of the wolf packs in Oregon, it is reasonably foreseeable that wolves will disperse into California and eventually establish reproducing packs The Department is currently in the process of developing a California Wolf Plan with the primary goal of providing for the long-term conservation and management of wolves in the state once they establish a population or packs in California.

Comment [EC23]: While listing a species that does not exist in California under CESA is premature, if the state of California truly has long-term conservation of wolves in the state as its objective, then strong provisions will need to be made to enable this, given that the gray wolf is to be delisted federally in the US.

A key finding is that the gray wolf is not currently facing or enduring any threat in California at this time. However, the primary threats that will face the gray wolf in California will likely be managing cohabitation with humans where there is a fear for personal safety, a threat to personal livelihood, or both; and the availability of suitable habitat and prey. Other threats that feasibly could affect colonizing wolves and sustainable wolf populations include limited competition, disease, small population size, limited genetic diversity, habitat fragmentation, road kill, human exploitation and other human disturbances. However, as seen since 1995 in the western U.S., wolves are a resilient species and can increase in numbers where adequate habitat and prey are available.

LISTING RECOMMENDATION

In consideration of the scientific information contained herein, the Department has determined that the petitioned action is/is not warranted at this time.

PROTECTION AFFORDED BY LISTING

In the absence of gray wolf in California, listing would provide no protection to the species. The following is a discussion of potential protection that could be afforded to the gray wolf in California if listed under CESA. While the protections identified in this section would help to ensure the future conservation of wolves if and when they enter the state, significant protections are now in place and would continue if the wolf were not listed under CESA. These include its current federal status, the focus on long-term conservation and management through the development and implementation of the California Wolf Plan currently underway, current CEQA requirements, and existing laws and regulations that make it illegal under State law to take wolves in California.

Protection under CESA

It is the policy of the State to conserve, protect, restore and enhance any endangered or any threatened species and its habitat. (Fish & G. Code, § 2052.) The conservation, protection, and enhancement of listed species and their habitat is of statewide concern (Fish & G. Code, § 2051(c).) As noted earlier, CESA defines "take" as hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill. (*Id.*, § 86.) Any person violating the take prohibition would be punishable under State law. As to authorized take, the Fish and Game Code provides the Department with related authority under certain circumstances. (*Id.*, §§ 2081, 2081.1, 2086, 2087 and 2835.) When take is authorized through an incidental take permit the impacts of the must be minimized and fully mitigated, among other requirements.

Increased protection of gray wolves following listing would also occur with required public agency environmental review under CEQA and its federal counter-part, the National Environmental Policy Act (NEPA). CEQA and NEPA both require affected public agencies to analyze and disclose project-related environmental effects, including potentially significant impacts on endangered, rare, and threatened special status species. Under CEQA's "substantive mandate," for example, state and local agencies in California must avoid or substantially lessen significant environmental effects to the extent feasible. With that mandate and the Department's regulatory jurisdiction generally, the Department expects related CEQA and NEPA review will likely result in increased information regarding the status of gray wolves in California as a result of, among other things, updated occurrence and abundance information for individual projects. Where significant impacts are identified under CEQA, the Department expects project-specific required avoidance, minimization, and mitigation measures will also benefit the species. While both CEQA and NEPA would require analysis of potential impacts to wolves regardless of their listing status under CESA, the acts contain specific requirements for analyzing and mitigating impacts to listed species. In common practice, potential impacts to listed species are examined more closely in CEQA and NEPA documents than potential impacts to unlisted species. State listing, in this respect, and required consultation with the Department during state and local agency environmental review under CEQA, is also expected to benefit the

species in terms of related impacts for individual projects that might otherwise occur absent listing.

If the gray wolf species is listed under CESA, it may increase the likelihood that State and Federal land and resource management agencies will allocate funds towards protection and recovery actions. However, funding for species recovery and management is limited, and there is a growing list of threatened and endangered species.

Preparers

This report was prepared by R. Lee, with cartography by K. Fien and invaluable assistance from the following Department employees: D. Applebee, E. Loft, K. Smith, A. Donlan, M. Stopher, K. Kovacs, and K. Converse. The Department is grateful for the scientific peer review of the final draft of this document generously provided by ___.

Consideration of Public Comments

The following is a summary of the comments received since the gray wolf was advanced to candidacy in October 2012. The Department issued a public notice seeking information related to the status of the gray wolf in California. The letters and input received is available for review at the Department of Fish and Wildlife, 1812 Ninth St., Sacramento. Comments submitted were evaluated for any scientifically-based information that would inform the Department as it related to this status assessment of the gray wolf in California.

Letters in Support of Listing

J. Capozzelli (letter) – April 22, 2013
Battle Creek Alliance (letter) – May 5, 2013
Society for Conservation Biology (letter) – May 6, 2013
California Wolf Center (letter and 147 scientific documents) – May 6, 2013
Center for Biological Diversity (letter) – May 6, 2013
The Humane Society of the United States (letter) – May 6, 2013
Project Coyote/Animal Welfare Institute (letter) – May 6, 2013 support listing
Public Interest Coalition – May 6, 2013 (letter)
Christina Eisenberg, PhD, (letter) – May 6, 2013
>6,000 emails supporting listing

Letters Not in Support of Listing

Jack Griffiths (letter) March 9, 2013
County of Lassen, California (Resolution) April 17, 2013
California Farm Bureau Federation, California Cattlemen's Association, and California Wool Growers Association (letter & research article) – May 6, 2013
<100 emails opposed to listing

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Lee, Rhianna@Wildlife

Subject: FW: Gray Wolf Petition (California Endangered Species Act) - Status Review for California
Attachments: Gray Wolf 2013 Status Review for Peer Review Johnson.doc

From: Johnson, Douglas E. [mailto:douglas.e.johnson@oregonstate.edu]
Sent: Thursday, November 14, 2013 9:39 AM
To: Loft, Eric@Wildlife
Subject: RE: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Dear Dr. Loft,

I have review the status Review of the Gray wolf in California and my comments are contained as comments in the document itself. The document was well researched, clear, and well written. Wolves are very adaptable animals and their expansion since re-introduction has been remarkable. I think you have overemphasized habitat requirements at places in the document that I have noted.

Good luck with your review and subsequent efforts in this endeavor.

Sincerely,

Douglas E. Johnson
Professor Emeritus
Department of Animal & Rangeland Sciences Oregon State University Corvallis, OR 97331 USA

Phone: 541-737-1624

From: Loft, Eric@Wildlife [Eric.Loft@wildlife.ca.gov]
Sent: Friday, October 18, 2013 12:02 PM
To: Johnson, Douglas E.
Subject: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Dear Dr. Johnson,

Thanks for your tentative agreement to review the subject document attached here (WORD document plus PDF of appendix/figures). Please review the attached letter (PDF) describing our intent, purpose, and request of you as a reviewer. I understand that plans may change and you may not be able to review the document for us. If that is the case please let me know as soon as practical. Otherwise, thank you very much in advance for your expertise and insight regarding the document.

Please contact me by email or telephone if you have any questions/concerns about this effort.

Sincerely,

Eric

Eric R. Loft, Ph.D, Chief
Wildlife Branch

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Sent: Friday, September 27, 2013 9:25 AM
To: Loft, Eric@Wildlife
Subject: RE: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Eric:

You can put me down as a tentative "yes" for your scientific review of the California Department of Fish and Wildlife's status assessment on the gray wolf in California.

Sincerely,

Doug

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STATE OF CALIFORNIA
NATURAL RESOURCES AGENCY
DEPARTMENT OF FISH AND WILDLIFE

REPORT TO THE FISH AND GAME COMMISSION

A STATUS REVIEW OF THE **GRAY WOLF** (*Canis lupus*) IN CALIFORNIA

Photo courtesy of ODFW

CHARLTON H. BONHAM, DIRECTOR
CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

October 2013 - PRELIMINARY DRAFT FOR REVIEW

Report to the Fish and Game Commission

A Status Review of the Gray Wolf in California

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EXECUTIVE SUMMARY

To be completed with final draft and will reflect the content of the Status Review

INTRODUCTION

Petition Evaluation Process

On March 12, 2012, the California Fish and Game Commission (Commission) received the "Petition to List the Gray Wolf (*Canis lupus*) as endangered under the California Endangered Species Act" (March 5, 2012; hereafter, the Petition), as submitted by the Center for Biological Diversity, Big Wildlife, the Environmental Protection Information Center, and the Klamath-Siskiyou Wildlands Center (collectively "Petitioners"). Commission staff transmitted the Petition to the Department of Fish and Wildlife (Department) pursuant to Fish and Game Code (FGC) section 2073 on March 13, 2012, and the Commission published formal notice of receipt of the Petition on April 13, 2012 (Cal. Reg. Notice Register 2012, No. 15-Z, p. 494). After evaluating the Petition and other relevant information the Department possessed or received, the Department determined that based on the information in the Petition, there was sufficient scientific information to indicate that the petitioned action may be warranted, and recommended the Commission accept the Petition (CDFG 2012). The Commission voted to accept the Petition and initiate this review of the species' status in California on October 3, 2012. Upon publication of the Commission's notice of determination, the gray wolf was designated a candidate species on November 2, 2012 (Cal. Reg. Notice Register 2012, No. 44-Z, p. 1610).

Status Review Overview

Following the Commission's action designating the gray wolf as a candidate species, and as per FGC section 2074.4, the Department solicited information from agencies, educational institutions, and the public to inform the review of the species status using the best scientific information available. This report contains the results of the Department's status review, including independent peer review of the draft report by scientists with expertise relevant to the gray wolf.

While the Department believes sufficient scientific information exists to conclude that wolves occurred historically within California, it is unknown to what extent, as the species was extirpated from the state by the late 1920's. At the present time, no individual, pack, or population of gray wolf is known to occur in California. With the recent gray wolf expansion in the western United States, a lone gray wolf known as OR7 dispersed from Oregon's wolf population to California in December 2011 and is now back in Oregon (as of Fall 2013). It is feasible that gray wolves will eventually attempt to establish a breeding population in California in the foreseeable future.

There is no specific, biological/ecological data available on the gray wolf in California to inform decision-making, however, the Department believes there is relevant and applicable scientific information from elsewhere concerning wolf biology, ecology, populations, management, and

potential threats. Because of the differences in natural communities, management, and possibly other human-related factors between California and other western states and provinces, the degree of certainty to which information on wolf status and conservation from other locations can be used to predict a future status in California is unknown. The purpose of this status review is to fulfill the mandate as required by FGC 2074.6 and provide the Commission with the most current scientifically based information available on the gray wolf in California and to serve as the basis for the Department's recommendation to the Commission.

BIOLOGY AND ECOLOGY OF THE GRAY WOLF

Species Description

The gray wolf is the largest wild member of the dog family (*Canidae*). Depending upon subspecies, the range of sizes in both sexes is widely variable. Throughout their range, female adult gray wolves weigh from 40-120 pounds (18-55 kg), and measure from 4.5-6 feet (1.37-1.52 m) in total length. Adult males, which are generally slightly heavier and larger than females, vary in weight from 45-175 pounds (20-80 kg) and in total length from 5-6.5 feet (1.27-1.64 m). Shoulder height ranges from 27-32 inches (700-800 mm) (Mech 1974; Paradiso and Nowak 1982). Typical weights for adult female gray wolves in Montana are 80-100 pounds, and for adult males are 90-110 pounds (WDFW 2011).

Wolves are apex carnivores that prey on large herbivores such as elk, moose, bison, and deer. Because they occupy the top of the food chain, wolves can influence other species on all trophic levels from predators and prey to plants (USFWS 1987; Mech and Boitani 2003). Although mortalities to wolves have occurred from mountain lions, bears, from other wolves, and other large mammals, for the most part they do not have any natural predators (Mech 1970; Robbins et al. 2010). Wolves tend to select more vulnerable or less fit prey and are known to selectively hunt young or older animals, and those injured or diseased in greater proportion but~~than~~ healthy adult individuals are preyed upon (e.g., Mech 1970, Fritts and Mech 1981, Kunkel and Pletscher 1999; Stahler et al. 2006).

Systematics

Classification: The taxonomy of wolves in North America is complex, made more challenging by the fact that wolves were extirpated over large portions of their range prior to the earliest attempts to scientifically categorize the subspecies (Chambers et al. 2012). Due to a scarcity of verifiable samples, very little is known about which subspecies of wolf occurred in California. The first comprehensive review of North American subspecies of *C. lupus* identified three subspecies which historically may have occurred in California: the Cascades Mountains wolf (*C.l. fuscus*) in Northern California, the Southern Rocky Mountains wolf (*C.l. youngi*) in the Mojave Desert region, and the Mogollon Mountain wolf (C*.l. mogollonensis*) in the Colorado Desert region (Goldman 1944, Hall 1981). All three historical subspecies are now extinct. More recent revisions of North American wolf taxonomy by Nowak (1995, 2002, 2003) grouped the three historical California subspecies within the subspecies *C.l. nubilis*, the plains wolf. These revisions have recently been supported by Chambers et al. (2012). It is also possible that the Mexican wolf subspecies (*C.l. baileyi*), recognized under both the historical and contemporary classifications), particularly dispersing individuals, may have occasionally entered the extreme southeastern corner of California.

The most recent work suggests that the different North American subspecies are derived from three separate historical invasions of the continent by wolves from Eurasia, the first wave being ancestors of *C.l. baileyi*, the second wave ancestors of *C.l. nubilis*, and the most recent wave ancestors of *C.l. occidentalis* (Chambers et al. 2012). Chambers et al. (2012) found genetic and physiological differentiation between *C.l. nubilis* and *C.l. occidentalis* and supported Nowak's (1995, 2002) delineation of the separate subspecies. The genetic differentiation between *C.l. nubilis* and *C.l. occidentalis* indicates that each subspecies is more closely related to some European wolf subspecies than to each other.

The only wild wolf known to occupy California in recent times (OR7), entered California from an Oregon wolf pack. The Oregon wolf population was established from wolves emigrating from Idaho. The Idaho wolves originated from translocated wolves (*Canis lupus occidentalis*) captured in the Rocky Mountains of British Columbia and Alberta (Montana Fish, Wildlife, and Parks 2013). Wolves in certain Central Washington packs have been found to carry an admixture of both *C. l. occidentalis* and *C. l. nubilis* genes (Martorello 2013). Thus, the most recent wolf to occupy California, and the wolves most likely to colonize California in the future may be of a different subspecies than the wolves historically inhabiting the state. Information on wolf subspecies is presented for biological background. The Petition however, would apply to all *C. lupus* subspecies including the Mexican wolf.
Life Span: Wolves reportedly live an average of 4-5 years in the wild (Mech 2006), although they can live up to 15 years (Ausband et al. 2009); and have been reported living longer in captivity.

Geographic Range and Distribution
Of relevance to California, the gray wolf currently inhabits the Northern Rocky Mountain States, Washington, and Oregon. This distribution is largely due to the efforts of the US Fish and Wildlife Service (USFWS) who drafted the Northern Rocky Mountain Wolf Recovery Plan in 1980 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 revised plan recommended recovery through natural re-colonization primarily from Canadian wolf populations. Reintroduction was recommended for Central Idaho if natural re-colonization did not result in at least two breeding pairs there within 5 years.

In 1982, wolves from Canada began to naturally occupy Glacier National Park in Northwestern Montana, and in 1986 the first litter was recorded. In 1995 and 1996, 66 gray wolves from Canada were introduced to Yellowstone National Park (31) and Central Idaho (35) as non-essential experimental populations (USFWS 2003), while the population in Northwestern Montana continued to increase naturally. 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 recent years, wolves have expanded into Washington and Oregon (CDFW 2011a).

Historical Perspective - California

The history of native California peoples suggests widespread distribution of knowledge and awareness of the wolf prior to European settlement. Of over 80 tribes that once existed, at least 15 were known to have separate words for wolf, coyote, and dog, and/or referenced the wolf in their stories, beliefs, and rituals (Geddes-Osborne and Margolin 2001, Newland and Stoyka 2013). This is consistent with the hypothesis that wolves were widely distributed in California.

There are numerous historical records of wolves in California, dating back to the 1700s. A number of the records from the early 1900s are from reputable sources: state and federal agency staff, biologists, and experienced backcountry travelers. The historical wolf records in California were summarized during the initial 90-day petition evaluation and these wolf occurrences are described in Appendix A. Some of the anecdotal observations are ambiguous as to whether the observer was reporting a wolf or a coyote, and until recently, only four physical specimens existed from California.

The Department was aware of four presumptive specimens housed in the Museum of Vertebrate Zoology at the University of California, Berkeley that were identified as wolves (i.e. *Canis lupus ssp*. (2), *Canis lupus fuscus*, and *Canis lupus youngi*). The Department, in collaboration with the UCLA Conservation Genetics Resource Center, sampled all four of these specimens. Preliminary results indicated that two of the specimens were wolves that may have occurred naturally in California (CDFW and Conservation Genetics Resource Center, unpubl. data).

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) also 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 the southwestern subspecies than the gray wolf to the north. Indeed the genetic work supports this conclusion as the results for this specimen has only been observed in historical and current captive sample of the Mexican wolf (*Canis lupus baileyi*) (CDFW and Conservation Genetics Resource Center, unpubl. data).

The second 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 56 pounds, it was estimated that in good condition it would have weighed approximately 85-90 pounds (Grinnell et al 1937). The preliminary analysis of this animal suggests that it represents a common *Canis lupus* origin (CDFW and Conservation Genetics Resource Center, unpubl. data).

Of the two other California specimens; one was determined to be a domestic dog (collected in 1982 Tehama County) and interestingly analysis on the other specimen (collected in 1962

Tulare County) indicated its genetic information had only been observed in modern far-north Alaska-Northwest Territories. Based in part on the collection date of 1962, it is speculated that this specimen was purposefully brought into California by humans (CDFW and Conservation Genetics Resource Center, unpubl. data).

While limited, the available information suggests that wolves were distributed widely in California, particularly in the Klamath-Cascade Mountains, North Coast Range, Modoc Plateau, Sierra Nevada, Sacramento Valley, and San Francisco Bay Area. While the majority of historical records are not verifiable, for the purposes of this status review, the Department concludes that the gray wolf likely occurred in much of the areas depicted (CDFW 2011a) (Figure 1). Still, it is not possible to assess the utility and accuracy of the recorded and ethno historical information in reconstructing a map of historical gray wolf distribution in California, and the true historical distribution remains uncertain.

Historical Perspective – Oregon

The Department considers the range and distribution of gray wolves in Oregon to be relevant to California because Oregon is the most likely source for wolf dispersal into California. According to Bailey (1936), there were two native species of gray wolves in Oregon prior to being extirpated in the 1940s, *Canis lycaon nubilus* (east) and *C. l. gigas* (west), with ranges separated geographically east and west of the Cascade Mountains. *C.l. nubilus*, the species associated with the plains states, was called a variety of names including buffalo or plains wolf. *C.l. gigas* was known as the northwestern timber wolf, which was found along the Western Pacific Coast. Modern classification schemes do not recognize *C. l. gigas* as a subspecies and all wolves historically occupying Oregon would be classified as *C. l. nubilus* (Nowak 2002, Chambers et al. 2012).

Based on the historical information available for Oregon (Bailey 1936), it is possible that wolf distribution in Northern California would have been similar to that of the coastal and plains distribution found to the north, but the extent to which wolves ranged south into California is uncertain.

Reproduction and Development

In a healthy wolf population with abundant prey, a reproductive pair may produce pups every year. Females and males generally begin breeding as 2-year olds. Normally, only the dominant pair in a pack breeds, and packs typically produce one litter annually (Mech and Boitani 2003). The gestation period for wolves is 62-63 days. Most litters (1 to 11 pups) are born in early to mid-spring and average five pups. Pups are cared for by the entire pack, and on average four pups survive until winter (USFWS 2009).

Denning: 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 450 g (14.5 oz) (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 the young wolves are almost fully grown, they begin traveling with the adults.

Food Habits

Wolves are adapted to feeding on a diverse array of foods. As generalist carnivores, wolves can and do hunt prey that range in size from snowshoe hares (*Lepus americanus*) to bison (*Bison bison*), depending upon season and geographic location (Peterson and Ciucci 2003). In North America, wolves' winter diet is dominated by ungulates which are vulnerable to snow accumulation, and juveniles are the most common age class killed (Mech and Peterson 2003). In summer, North American wolves are able to consume a more diverse diet, and are often found to consume beavers, ground squirrels, coyotes, salmon, insects, and plant matter (Smith 1998; Peterson and Ciucci 2003; Darimont et al 2004), although ungulates represent most of the biomass consumed (Ballard et al 1987; Fuller 1989b).

Based on studies in Alberta, Canada, wolf predation on deer equaled that of elk (42% each); however, considering the biomass available to wolves, elk contributed 56% compared to 20% each for deer and moose (Weaver 1994). In British Columbia, black-tailed deer are the most common prey along coastal areas, and moose constitute much of wolf prey in the more southern areas (Darimont et al 2009; Mowat 2011). In the Northern and Central Rocky Mountains, elk are frequently the most important prey of wolves, but deer and moose comprise more in some areas (Huggard et al 1993; Boyd et al 1994; Mack and Laudon 1998; Arjo et al 2002; Husseman et al 2003; Kunkel et al 2004; Smith et al 2004; Atwood et al 2007). In areas where wolves and livestock co-occur, wolves have been known to kill and consume sheep, cattle, goats, horses, llamas, livestock guard dogs, and domestic pets (Bangs and Shivik 2001).

While OR7 was in California, he was observed pursuing a doe black-tailed deer. Based on evidence of known GPS locations (confirmed with wolf tracks and suspected wolf scat) it is believed that OR7 has fed on feral horse, bones at a livestock carcass pile, mule deer and mule deer fawns, and was suspected to have fed on ground squirrels. With the exception of the livestock carcass pile, it was not possible to determine if these food items were killed or scavenged (Kovacs 2013).

Wolf populations depend on the amount of prey biomass available (Packard and Mech 1980) and because prey abundance can vary from year-to-year, wolf population can also fluctuate (Fuller et al. 2003). Although mostly dominant when it comes to other predator species, competition for prey can occur with mountain lion, coyote, fox, and bear, as well as intraspecific competition with other wolf populations. The numerous mortality factors that prey species populations are subject to, such as starvation resulting from poor habitat conditions, winter kill, predation, road-kill, disease, and sport hunting also affect the amount of prey available to wolves.

Although a larger pack is more effective in capturing prey, this manner of hunting has been reported to result in less food per member. In contrast, when lone wolves and wolf pairs are able to capture prey, the amount of food obtained per wolf is greater when they are successful, although they are less successful each time they hunt (Fritts and Mech 1981; Ballard et al. 1987,

1997; Thurber and Peterson 1993; Hayes and Harestad 2000). Single wolves have been known to bring down an adult moose (Cowan 1947). However, the amount of food that can be utilized when a large prey animal is taken by one or two wolves is limited and without a sufficient number of feeders, this surplus can be lost to competitors, scavengers, insects, and bacteria (Mech and Boitani 2003), even when cached. Therefore, sharing the surplus of large prey with family members appears to be the most efficient approach adult wolves can take to enhance the survival of their offspring and their fitness (Mech 1970, 1991; Schmidt and Mech 1997).

As wolves occupy the role of apex predator, the ecosystem can be modified by influencing behavior, distribution and abundance of prey species, with subsequent indirect effects on habitat (USFWS 1987) and by influencing distribution and abundance of other predators (Levi and Wilmers 2012). Additionally, wolves influence ungulate population health and distribution (White et al. 2005, 2012; Smith 2012).

Territory/Home Range

Wolf packs live within territories they defend from other wolves. In areas with a well-established wolf population, a mosaic of territories develops. Packs compete with each other for space and food resources through widespread, regular travel, during which they scent-mark as a means of maintaining their territorial boundaries. Howling at specific locations serves to reinforce these scent-marks (Mech and Boitani 2003).

Territory size is a function of interdependent factors. Wolf pack size, prey size, prey biomass, prey vulnerability, and latitude are all factors that have been recognized as influencing the size of wolf territories. The smallest recorded territory was 13 square miles in northeastern Minnesota, defended by a pack of six wolves (Mech and Boitani 2003). The largest territory on record, defended by a pack of ten, was 2,450 square miles in Alaska (Burkholder 1959). Wolf territories in the northern Rocky Mountains typically range from 200-400 square miles (322-644 km^2) (USFWS 2003).

Wolf territories are known to shift seasonally due to changes in movements of ungulate species (Mech and Boitani 2003). In summer, the den is the social center with adults radiating out in foraging groups of various sizes (Murie 1944; Mech 1970). In winter, packs will sometimes split up to hunt in smaller groups, and pack members may lag behind to visit old kills or disperse temporarily (Mech 1966).

The two primary functions of wolf travel within the territory are foraging and territory maintenance (i.e., boundary maintenance via scent-marking), of which they apparently do both simultaneously (Mech and Boitani 2003). Wolves range over large areas to hunt and may cover 30 mi (48 km). or more in a day. The breeding pair is generally the lead hunters for the pack. 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). Within-territory movements differ between pup-rearing season and the rest of the year (Mech et al 1998). While pups are confined to the den or other rendezvous sites, movements of adults radiate out from and back to that core position (Murie 1944). Once pups are able to travel with the adults, movements become more nomadic throughout the territory (Burkholder 1959; Musiani et al 1998).

Rendezvous Sites: After the natal den is abandoned, wolves are known to use "rendezvous sites" as specific resting and gathering areas in summer and early fall, generally consisting of a meadow complex and stream, with an adjacent forest (Murie 1944; Carbyn 1974). Rendezvous sites where cover is sufficient are sometimes used for training and hiding pups, once they have reached an age where the den is no longer capable of containing them (Mech and Boitani 2003).

Dispersal: Some wolves remain with their natal packs for multiple years, but most eventually disperse. Dispersing wolves may conduct temporary forays, returning several times before finally dispersing permanently (Fritts and Mech 1981; Van Ballenberghe 1983; Gese and Mech 1991), while others disperse once, never to return (Mech 1987; Mech et al 1998).

A few differences have been detected between the sexes in terms of dispersal characteristics. In some areas or years, males may disperse farther than females (Pullainen 1965; Peterson et al 1984), but at other times or locations, females disperse farther (Fritts 1983; Ballard et al 1987), so the average dispersal distance is about the same for both sexes (Mech and Boitani 2003). Wolves disperse throughout the year; however fall and spring tend to be the peak periods. Dispersal primarily during these periods suggests that social competition may be a trigger. In the spring when pups are present, aggression from the breeding adults may occur (Rabb et al 1967; Zimen 1976), and in fall when pups are traveling with adults, food competition may be at its peak (Mech 1970; Mech and Boitani 2003).

The average dispersing distance of northern Rocky Mountain wolves is about 60 miles, although 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 (GPS) technology, exceeding 6,000 miles (USFWS et al 2011). In general younger wolves disperse farther than older wolves (Wydeven et al 1995). This is possibly explained by older dispersers having more familiarity with the local terrain, and hence perceiving greater opportunity locally, whereas younger, more naive dispersers wander farther seeking security in areas not already inhabited by hostile wolves (Mech and Boitani 2003). There is some evidence that when wolves do travel long distances, they move in a manner that seems goal-directed (Mech and Frenzel 1971). One explanation is that, unable to establish a territory locally, the animal is predisposed to travel in a certain direction for some particular distance or time before looking to settle (Mech and Boitani 2003).

In recent years, dispersing wolves from British Columbia, Montana, and likely Idaho have established packs in Washington, and dispersers from Idaho have established in Northeastern Oregon. The radio-collared male wolf OR7 dispersed into California in December, 2011 and remained in the state for over a year. OR7 returned to Oregon in March, 2013, and continues to remain in an area approximately 300 miles from any known wolf pack. Oregon Fish and Wildlife officials believe he is not accompanied by other wolves. As of the time that he left California, the Department estimated that he had traveled approximately 4,500 air miles.

Colonization: As wolves colonize or recolonize an area, the initial pack can proliferate quickly as conditions permit. This proliferation occurs in part through dispersal from the founding pack,

and in part from additional immigration (Mech and Boitani 2003). Wolves in newly colonized regions may shift their territories over large areas. In these newly colonized areas territories tend to be exclusive initially, but may overlap with other territories as the region becomes saturated (Hayes 1995). In general, as areas become saturated with wolf territories, the boundaries may shift but the cores tend to remain approximately the same (Mech and Boitani 2003).

Habitat Use

Wolves are habitat generalists and historically occupied diverse habitats in North America, including tundra, forests, grasslands, and deserts. They also occupy diverse topographies form plains to mountains. 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 a number of variables, including availability and abundance of prey, availability of den sites, ease of travel, snow conditions, livestock density, road density, human presence, topography and continuous blocks of public lands. While suitable habitat generally consists of areas with adequate prey where the likelihood of human contact is relatively low (Mladenoff et al. 1999) wolves are highly adaptable and can occupy a range of habitats, however, human tolerance to the presence of wolves may be an important factor (Mech 2006).

Wolves require adequate space for denning sites located away from territory edges to minimize encounters with neighboring packs and avoid other potential disturbances while birthing and raising pups. Den site selection and preparation may occur as early as autumn (Thiel et al 1997), with non-breeding members of the pack participating in the digging of the den and providing other general provisions to the breeding female. Rendezvous sites where cover is sufficient are sometimes used for training and hiding pups once they have reached an age where the den is no longer capable of containing them (Mech and Boitani 2003).

Habitat Suitability Modeling: There are studies that have modeled potential suitable wolf habitat in California. Carroll (2001) modeled potential wolf occupancy in California using estimates of prey density, prey accessibility and security from human disturbance (road and human population density). Results suggested that areas located in the Modoc Plateau, Sierra Nevada, and the Northern Coastal Mountains could be potentially suitable habitat areas for wolves.

The Department has similarly developed a model in anticipation of a gray wolf conservation plan. Oakleaf et al. (2006) developed a model for the Northern Rocky Mountain (NRM) gray wolf Distinct Population Segment (DPS) and reported positive correlations with environmental factors (elk and forested habitats) and negative correlations between wolf occupancy and anthropogenic factors (human density and domestic sheep). The U.S. Fish and Wildlife Service developed a habitat suitability model for Idaho, which the Department modified for California based on the Oakleaf criteria; percent forest cover, human population density, elk density, and domestic sheep density. Currently, the Department believes that the Oakleaf model (subsequently validated in 2010 with respect to wolf survivorship) provides a rigorous approach and is based on fewer assumptions than other modeling efforts that have been conducted and which cover California (Figure 2).

Comment [DEJ1]: Our unpublished data indicates that 11.24% of all GPS wolf positions were within 60m of a road (2018 of 17954) in a study area that had 12.69% of the area in a 60m road buffer and that 5.76% of all wolf positions were within 30m of a road (1034 of 17954) with 6.35% of total study area within a 30m road buffer. So, in this study, the collared wolf spent time on roads roughly in proportion to their occurrence on the landscape. Wolves may use roads as travel corridors in rough terrain. We have recorded 2 hr. 48 minutes of continuous travel by a wolf on rural roads.

As more data is gathered the picture will become clearer.

Comment [DEJ2]: USFW (2007) Stated "It was thought that gray wolves were a wilderness species, but wolf range has expanded into areas that we once thought could not support them. In Minnesota and Wisconsin, wolves have shown that they can tolerate more human disturbance than we previously thought. Consequently, it appears that wolves can survive anywhere there is sufficient food and human tolerance to allow their existence".

We GPS-tracked (15 min logging interval) a healthy, adult, male wolf in western Idaho that spent 3.1% of his time within 500 m of an occupied house in spite of houses being relatively rare. The closest recorded GPS positions were within 100m of the house. Most wolf interactions near houses were at night when human activity was low. Wolf scat and sign has been found adjacent to barnyards and on one occasion his pack spent 24 continuous hours on a hillside overlooking a farmyard that was 350 meters away. Documented wolf predation on domestic livestock is often close to farms, ranches, and homes.

Some wolves appear to be quite tolerant of human activities.

CONSERVATION STATUS

In assessing conservation status for the gray wolf in California, the Department considers the status of the gray wolf in Oregon to be relevant, as wolves from Oregon would be the most likely source population in the future. Consequently, the status assessment as it relates specifically to animal population, trend, and distribution includes a brief overview of Oregon.

In regard to the Mexican wolf, the Department is of the understanding from both the U.S. Fish and Wildlife Service, and the Arizona Game and Fish Department, that the likelihood of wolves entering California from Arizona is so remote that the Fish and Wildlife Service did not include California as potential range in developing the recent Distinct Population Segment (DPS) for this subspecies. Because occurrence in California is so unlikely by the Mexican wolf, and the scientific information on wolf use of the deserts of Southern California is non-existent, the Department has concluded conducting a reasoned status evaluation for this animal is not feasible as it is for the gray wolf in northern California.

Trends in Current Distribution and Range

California: With no gray wolf population, there is no trend in distribution or range in California and it is not possible to assess a trend as there is no scientific data available for California. The only known natural occurrence of the gray wolf in California since extirpation has been OR7, the wolf that traveled south from Oregon (CDFW 2011b). The dispersal pattern of OR7 during his visits to California is provided but the Department does not consider the travels of this individual to constitute a geographic area of wolf range. At the time of this status review OR7 is in Southern Oregon (Figure 3).

Oregon: In 1999, dispersing wolves were first observed in Oregon. As the reintroduced Idaho wolf population expanded, increasing numbers of dispersing wolves eventually established packs in both Oregon and Washington by 2009. The range of the gray wolf in Oregon has been expanding since that time.

In 2010, there were two known packs; the Imnaha (OR7 pack of origin) and the Wenaha packs with 15 and 6 wolves, respectively. In 2011, three additional packs were known in Oregon; the Walla Walla, Snake River, and Umatilla River packs. In 2012, one more pack was established; the Minam pack. There is also another known pair located in that same general area, the Sled Springs pair that has an undetermined breeding status. In addition, there are at least three wolves are not associated with any pack (ODFW 2011), including OR7. As of June 2013, there are 6 established wolf packs in Oregon, all in the northeastern part of the state (Figure 4). Because of the growth in the Oregon wolf population, an expansion southward appears feasible in the foreseeable future.

Comment [DEJ3]: There is now a ount Emily Pack as well.

Population Trend

California: There is no known population of gray wolf in California, therefore population estimate and trend information does not exist.

Oregon: The current abundance of Oregon wolves through 2012 is estimated by ODFW to be a minimum of 46 animals. The Oregon wolf population has increased each year from 2009 through 2012, with the minimum number of wolves reported to be 14, 21, 29, and 46 animals, respectively (ODFW 2013a). The true number of wolves in Oregon was undoubtedly higher each year as not all wolves were likely detected. Whether this rate of increase will continue, or whether a similar rate of population growth could be expected to occur in California if a wolf pack(s) became established, is uncertain and is likely dependent on a number of factors, including habitat suitability and prey availability.

Comment [DEJ4]: Prey availability is primary. A broad variety of habitats are used by wolves. Wolves are very plastic in vegetative and topographic habitat requirements. I would focus on prey availability and downplay specific habitat requirements.

Habitat Essential for Continued Existence of the Species

Fish and Game Code section 2074.6 requires that a status review include preliminary identification of the habitat that may be essential to the continued existence of the species.

Wolves are wide ranging and can use varied habitats. Habitat used by wolves in other western states appear similar to California forest and rangeland habitats. These observations and an understanding of wolf life history, are considered relevant in developing a potential model of essential habitat for California. These factors contribute to the below discussion of potential, or possibly, essential habitat should a gray wolf population occur in California. Large, undeveloped tracts of public land provide suitable habitat and are generally required for the establishment of wolf populations in North America (Paquet and Carbyn 2003). It is believed these large tracts of undeveloped land reduce human access and thereby provide some level of protection for wolves (Mech 1995). However, as gray wolves expand their range in the U.S., they may increasingly inhabit areas near 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.

Comment [DEJ5]: What do you mean by undeveloped? In Oregon, we have areas with mixed ownership (public and private) with new wolf packs from Idaho. Ranch land and forest land may appear from a distance to be undeveloped but local managers would probably disagree. Just think of the road and water developments, fencing and recreational developments in these areas.

The trick has always been to keep the wolves in the "undeveloped area" where you want them.

However, as no gray wolves are known to inhabit California, habitat essential for the *continued existence* of wolves is not presently at issue. Additionally, as no scientific data on habitat selection or preferences of gray wolf in California exists, it is not possible to describe essential habitat with certainty.

Factors Affecting Ability of the Gray Wolf to Survive and Reproduce

Degree and Immediacy of Threats: As far as the Department is aware, the gray wolf does not presently (September 2013) inhabit California. Consequently, there is no immediate threat to gray wolf survival and reproduction in California. However, due to the potential for wolves to become established in the future, the following factors may become relevant. Unless, and until, the gray wolf becomes established in California and first-hand scientific information becomes available, there is uncertainty in predicting the potential significance of these factors under California conditions.

Human Predation on Wolves: Fear of wolves has been passed down from generation to generation for centuries, partially due to danger that large predators pose to humans. A factor contributing to the legacy of fear is that historically, prior to modern medicine, bites by rabid wolves almost always resulted in death. Cases of "furious" wolf attacks have been documented with one wolf sometimes biting large numbers of people (Linnel et al. 2002).

Negative human attitudes toward wolves are largely based on a perceived threat to personal safety or livelihood. Early settlers and explorers viewed wolves and other large predators as a serious threat due to direct losses of livestock, but also as competitors with humans for the large ungulates which early settlers relied on in part for food. Wolves, grizzly and black bears, and mountain lions were actively killed as settlers moved west and were removed from most of the lower U.S. to allow a safe environment for the establishment of farms and ranches throughout the west. While nationwide, the overall loss of cattle due to wildlife is about 5.6 percent (219,900 cattle lost), wolves contributed 0.2 percent (8,100 cattle lost) of the total reported losses (3,992,900 total cattle lost). More than half of all predator losses are caused by coyotes (USDA 2011). However, public perceptions of wolves attacking people and the losses of livestock, continues to influence human attitudes toward wolves. Studies focused on the attitudes of people toward wolves as wolves have been reintroduced in the U.S. have shown a trend of increasing tolerance in some areas (Bruskotter et al. 2007), and a decreasing tolerance in others (Chavez et al. 2005).

Comment [DEJ6]: People that have experience living with wolves and have lost livestock, horses, dogs, etc. have a good understanding of wolves and what they can do. These attitudes aren't derived from fairy tales. I would remove the word "perceived".

Negative attitudes toward wolves would still likely be in place in California if the species establishes itself. However, development of sound management and conservation strategies involving California's diverse stakeholders, and communicating those strategies to the public may reduce the potential for this to be a threat by increasing human tolerance for wolves in the state.

Damage Control: The conflict between wolves and livestock producers, and the resultant take of wolves under depredation/damage control, constitutes a threat to individual wolves at a minimum and may represent a potential threat in California if the gray wolf populations were to become established in the state. Washington and Oregon have criteria to determine if wolves have become habituated to killing domestic animals and has steps to remove them, as necessary (ODFW 2012, WDFW 2012). However, the wolf populations in the Northern Rocky Mountains, and in Washington and Oregon, are continuing to increase in the presence of this threat suggesting that it is not likely a significant issue to maintaining wolf populations in these states.

Other Human Influences: Human take of wolves is the primary factor that can significantly affect wolf populations (USFWS 2000, Mitchell et al. 2008, Murray et al. 2010, Smith et al. 2010). Thus, conservation and recovery efforts for the wolf have been successful to a substantial extent by limiting human-caused wolf mortality and allowing populations to recolonize in several states. In recent years, public hunting of the gray wolf has been initiated in some states (such as Idaho and Montana) for species management purposes, resulting in substantial harvest of wolves, however, the long-term effects on the species population dynamics are not yet known.

Human population growth and increased human use of open spaces through urban and residential development, natural resource utilization (i.e., timber, mining, water use, agriculture, etc.), and increased access to public lands for human recreation all have the potential to impact habitat for wolves and influence the ability for populations to become established and sustainable over time (Carroll 2001, USFWS 2013). Other potential impacts to

wolves could occur from disease, vehicle strikes, urban growth, road development, highways (which pose barriers to wolf movements), dams, habitat loss and other development.

Comment [DEJ7]: Isn't it more likely that wolves will move into urban fringe areas rather than urban areas develop in locations occupied by wolves? We have not seen that road development or rural highways as barriers to wolf movement. Freeways and Interstate Highways would be a barrier and vehicle strikes do happen on busy highways. If you look at the track of OR-7 the picture should become clearer.

Prey Availability

In most northwestern states, elk and moose are the primary prey species for wolves (USFWS 1987). In Oregon and in the Great Lakes area, wolves prey on deer more when larger ungulate species are unavailable (ODFW 2010; USFWS 1987). In California, wolves would be expected to rely heavily on deer because elk population numbers are far fewer across the landscape. Wolves will take smaller prey or scavenge when necessary, but tend to prefer hunting larger ungulates (CDFW 2011a).

In California, it is unknown whether the available habitat supports or is capable of supporting, adequate numbers of the primary prey species, elk and deer, to sustain a wolf population combined with the other factors affecting these species. In northern California, where the gray wolf would likely first colonize, the current elk population is estimated to be approximately 7,000 animals across approximately 28,000 sq miles of wildland in the eight northern counties, and occurs at low densities except in the coastal zone (Figure 5). California's mule deer populations have been in a slow and steady decline since they peaked in the 1960's, and are down an estimated 50-70 percent in the northern counties where the habitat would otherwise appear to be potentially suitable for gray wolf. Additionally, California's other predators on deer and elk, specifically mountain lion, bobcat, coyote, and black bear, are considered common species and black bear have been increasing in population since the 1980s. The mountain lion (estimated population of 4,000-6,000 statewide based on a 1970s estimate) is a specially protected mammal for which no hunting can occur. The black bear population in California has approximately tripled in the past 25 years to over an estimated 30,000 animals statewide, with fewer than 2,000 typically harvested annually through hunting in most years (http://www.dfg.ca.gov/wildlife/hunting/bear/docs/2011BearTakeReport.pdf). These species would compete with the gray wolves for food. It is unclear what effect the presence of wolves in the state would have on the populations of black bears and mountain lions, although competition for resources would be expected to reduce the populations of these competing predators and the proportion of game animals taken by each of them might likely change. In California, the habitat for enough ungulate prey to sustain a viable wolf population in California is in need of restoration to increase deer and elk populations.

Habitat suitability models for the gray wolf (Carroll et al. 2001, Oakleaf et al. 2006, CDFW in prep.) take into consideration the estimated abundance of elk prey, but not deer prey. The Department is gathering information to adapt the Oakleaf et al. (2006) model to reflect our current information on the distribution and density of large ungulate prey in California (essentially combining Figure 2 and Figure 5). Until wolves attempt to enter and become established in California, it is not possible to determine with certainty whether a population can be sustained by the existing prey available in the state.

Competition

Competition for resources (e.g. food, space) occurs between wolves and other predators. Mountain lion, black bear, coyote, bobcat, and fox species are carnivorous animals that would likely be the most affected by wolves becoming established in California. It is unknown what

the interspecific relationships among the gray wolf and other predators would be, in particular for species that have unusual status already in California (the Sierra Nevada red fox is threatened under the California Endangered Species Act and the mountain lion is a "specially protected mammal" per legislation). Mountain lions are a common predator in California's deer ranges and are protected from take or harvest through legislation. It is likely that the mountain lion would be the primary competitor with wolves for deer. In Yellowstone National Park, as wolf numbers increased, mountain lions shifted to higher elevations and more north-facing slopes in the summer and in more rugged areas in the winter (Bartnick et al. 2013). Home ranges for wolves and mountain lions overlapped, but mountain lions avoided areas recently occupied by wolves (Kortello 2007). Whether these patterns would hold in California is uncertain as the habitats, weather, and prey base including ungulate migration patterns are different. No scientific information available to the Department suggests that competition with other predators is likely to pose a significant threat to wolves in California.

Black bears, another potential predator in California, are known to coexist with gray wolves although conflicts around wolf dens, bear dens, or food have resulted in either species being killed. Generally, adult bears are rarely killed by wolves but injured, young, or old bears have been known to be prey in some circumstances (Murie 1944, Ballard 1982, Paquet and Carbyn 1986, Koene et al. 2002). Black bears can also have impacts to ungulate populations and are known to hunt and kill the fawns of elk and deer to the point of having a substantial impact to the young-of-the-year in a given region (Rogers et al. 1990, White et al. 2010).

Small Population Size

The threats inherent to small, isolated populations would apply to any wolf or initial wolf population that may attempt to colonize California. A small wolf population would likely be less able to withstand and rebound from natural and human influenced causes of mortality . A small population size increases the risk of extirpation through demographic, environmental, and random genetic changes over time, particularly if the population is isolated; as well as through deleterious effects associated with low genetic diversity (Traill et al. 2007, Traill et al. 2010). The degree to which colonizing wolves are able to breed with and exchange individuals between packs in Oregon or other neighboring states will influence the significance of the threat posed by small population size.

The growth of wolf populations in and around the northern Rocky Mountains since 1995 provides evidence that the gray wolf, with appropriate conservation actions, can apparently overcome the threats associated with a small population size.

Climate Change

Climate change potentially offers both benefits and challenges for a future gray wolf population in California. Many prey and predator species have shifted their distributions towards higher latitudes and elevations due to climate change (Thomas 2010; Chen et al. 2011). It is predicted that temperature will increase and precipitation will decrease in California in coming decades (Van den Hurk et al. 2006; Cayan et al. 2012). Top consumer species at higher trophic levels have greater metabolic needs and smaller population sizes than those at lower trophic levels (Voigt et al. 2003; Vasseur and McCann 2005), which makes them more sensitive to climate change (Gilman et al. 2010). Other climate change predictions may influence the habitat's

ability to sustain wolf populations in California. For example, reduced forest vegetation in the Sierra Nevada and Cascade Mountains (Lenihan et al. 2008) due to increased temperatures and catastrophic fires (Fried et al. 2004) could limit suitable habitats for wolves, especially in terms of denning and cover requirements. Conversely, with increased wildfire in forest communities, early successional habitats that result would likely provide benefits to large herbivore prey species. Consequently, it is unknown what affect climate change will have on wolf and prey populations or distributions in California.

Diseases

Wolves are vulnerable to a number of diseases and parasites, including, mange, mites, ticks, fleas, roundworm, tape worm, flatworm, distemper, cataracts, arthritis, cancer, rickets, pneumonia, parvovirus, and Lyme disease. In colder northern regions, external parasites tend to be less of a problem (Idaho DFG 2013). Whether these diseases and parasites have, or would have, substantial impact on a gray wolf population in California is unknown. The primary known diseases and parasites are described below.

Canine distemper and canine infectious hepatitis: Both diseases are known to occur in wolves and more recently canine parvovirus has become prevalent in several wolf populations (Brand et al. 1995).

Mange: Mange consists of tiny mites that attach themselves to a wolf's fur or skin. In sarcoptic mange, intense itching occurs due to female mites' burrowing under the wolf's skin to lay eggs. In demodectic mange, the mites live in the pores of the skin and cause little or no itching. The symptoms of mange include skin lesions, crusting, and fur loss. Wolves that suffer mange in the winter lose fur that protects them resulting in hypothermia and possibly can cause them to freeze to death.

Canine Distemper: Canine distemper is a very contagious disease caused by a virus. The disease is often centers on the skin, eye membranes, and intestinal tract, and occasionally the brain. Symptoms include fever, loss of appetite, and a discharge from the eyes and nose. Diarrhea and dehydration may follow and in final stages seizures may occur (Brand et al. 1995). Canine distemper can result in periodic population declines in wild wolves (Almberg et al. 2010, Almberg et al. 2011)

Canine Parvovirus: The transmission of disease from domestic dogs, e.g. parvovirus, is a grave conservation concern for recovering wolf populations (Paquet and Carbyn 2003, (Smith and Almberg 2007). Recently, two wolves and two pups in Oregon were found to have died from parvovirus (ODFW 2013b). The disease is not thought to significantly impact large wolf populations, but it may hinder the recovery of small populations (Mech and Goyal 1993). It is currently unknown how much this disease may affect Oregon wolf populations or potential future California populations.

Canine Adenovirus (Hepatitis): Infectious canine hepatitis (ICH) is a contagious disease of dogs that can effect wolves, coyotes, foxes, bears, lynx and other carnivores with signs that vary from no visual signs to a slight fever and congestion of the mucous membranes to severe

depression, marked low white blood cell count, and blood clotting disorders. Although controlled by immunization in domestic animals, periodic outbreaks, which may reflect maintenance of the disease in wild and feral hosts, reinforce the need for continued vaccination of domestic pets (Merck 2013).

Rabies: Contrary to popular myth, rabies is very rare in wolves. Although rabies is fatal to wolves and has been detected in wild wolves in North America, the disease is not thought to be a major factor in the population ecology of wolves (Theberge et al. 1994).

Parasites: Roundworm, tape worm, flatworm, mange, mites, ticks, and fleas. *Echinococcus granulosus (E. granulosus):* is a very small (3-5mm) tapeworm that requires two different animal species, a canid and an ungulate, to complete its lifecycle and is already naturalized in CA (Idaho DFG 2013). It is not known to what extent these parasites may pose a threat to a future wolf population in California.

Other Risk Factors

Overexploitation: The possibility of future increased access to areas that are currently roadless, for resource extraction (logging, mining, etc.) or high-impact recreational activities (off-road vehicles, winter snowmobiling, etc.) could impact a future gray wolf population. However, given such activities are not substantially proposed in northern California, we do not consider them a potential risk factor under current public land management strategies. Other recreational activities (hiking, photography) could disturb wolves if they occur at sensitive times or in a manner that is especially disruptive if of long duration or high intensity. Poaching has the potential to impact wolf populations by affecting prey populations, or by the direct killing of wolves. The significance of these potential threats is unknown and would be difficult to quantify.

Comment [DEJ8]: I agree.

EXISTING MANAGEMENT, MONITORING, AND RESEARCH ACTIVITIES

Wolf Conservation and Management Strategies in California

Prior to OR7 arriving in California, the Department began developing background information in anticipation of such an event. A wolf planning document, Gray Wolves in California (CDFW 2011a), was completed that outlined basic information about the history, current conditions, potential for natural re-colonization and management implications. Once OR7 was in the state, the Department quickly worked with the USFWS and the USDA Wildlife Services to develop an interagency coordination plan to respond to events involving a wolf as needed (USFWS/APHIS/CDFW 2012).

At the time of this status review, the Department is working on a wolf plan for California. The primary goal of this plan is to develop a strategy for the long-term conservation and management of wolves in the state. The plan is on a schedule to be approved and in place by early 2015. The Department recognized the need to be proactive in developing a strategy for coordination with federal partners and to be responsive to the questions and concerns by a variety of stakeholder groups. A part of that preparation will require more detailed assessments of potential habitat capability in California. Additionally, the Department's deer and elk

programs are working toward development of more comprehensive assessments of prey species given the potential for the gray wolf to become established in California.

Monitoring

Coordination with the Oregon Department of Fish and Wildlife and the USFWS will continue in the effort of tracking radio and GPS collared wolves from Oregon packs. Additionally, general wildlife surveys that occur along the Northern California border will continue annually to monitor for a number of wildlife species, including wolves when yearly assessment work occurs in areas that might potentially detect dispersing wolves from Oregon. It is anticipated that monitoring will be considered as part of the wolf plan that is in the beginning stages of development by the Department.

Current Land Management Practices

The following land management summary applies to forests and ranges of California that could potentially be inhabited by gray wolf in the future. To the Department's knowledge, none of the current land management planning efforts being implemented have specific objectives, prescriptions, or actions related to the gray wolf.

Land management practices in California in areas of potential wolf habitat vary with ownership. Large areas of mid-elevation forest and meadow vegetation communities with low human density are the primary criteria used to estimate potential wolf management areas, although wolves can sustain a population in a variety of different habitat types. Fifty five percent (55%) of the forest land in California is publicly owned, the vast majority of which is owned and managed by the federal government (CDF 2010). The remaining 45% is privately owned. Most of the federal forest land in California is owned and managed by the United States Department of Agriculture Forest Service (USFS). The USFS manages 4,355,231 ha (10,762,000 ac) of conifer forest land in California (CDF 2010). The National Park Service (NPS) is another significant landowner in the species' potential California range, owning and managing 447,583 ha (1,106,000 ac) of conifer forest land (Ibid.). Although some potential habitat is owned and managed by California State Parks, the California Department of Forestry and Fire Protection, and other public agencies, most of the 2,692,376 ha (6,653,000 ac) of non-federal conifer forest land is privately owned (Ibid., Figure 6).

U.S. Forest Service Management: Land management on USFS lands is governed by the Land Resources Management Plan (LRMP) of each National Forest. The LRMPs of the Sierra Nevada National Forests were amended by the 2004 Sierra Nevada Forest Plan Amendment (SNFPA) which specifies that vegetation management strategies should be "aggressive enough to reduce the risk of wildfire to communities in the urban-wildland interface while modifying fire behavior over the broader landscape" (USDA Forest Service 2004).

On USFS lands, decisions about management actions are made giving consideration to the conservation of natural resources, restoration of ecological health, the protection of communities, as well as other considerations. Resource and ecological health considerations include conservation of the forest habitats utilized by the California spotted owl (*Strix occidentalis occidentalis*), northern goshawk (*Accipiter gentilis*), fisher (*Martes pennanti*), and

American marten (*Martes americanus*) (USDA Forest Service 2004). Additionally, forest managers assess potential impacts and long-term effects management actions may have on Management Indicator Species (MIS), species identified to represent the health of the various habitats managed in each forest. These species evaluations are done at the local level and at the bioregional scale, which analyze impacts related to information from population monitoring data and/or habitat trends of each potential effected MIS, as identified in each forest. The land management decisions on National Forest lands with the greatest potential to influence future wolf populations are those related to the elimination of early seral forest habitats, fire suppression, catastrophic wild fire, public access, livestock grazing, and road construction.

Comment [DEJ9]: I believe that current federal management is stable enough that most of these impacts, except catastrophic wildfire, would be felt through change in prey populations. Given the vast area that a wolf pack can occupy, they can be insulated from events at localities.

Bureau of Land Management: BLM rangelands are interspersed all through northern California, and provide valuable range for elk and deer. BLM lands are managed for multiple uses and livestock grazing occurs throughout areas potentially inhabitable by the gray wolf. Additionally, in the northeastern part of California, wild horses are common and could potentially be preyed upon by wolves. As with National Forest lands, the management decisions with the greatest potential to influence a future wolf population are related to the elimination of early seral forest habitat types, fire suppression, catastrophic wild fire, livestock grazing, and public access.

Comment [DEJ10]: See comment above.

National Park Service Management: There are a number of large, continuous areas of National Park Service lands with potentially suitable wolf habitat in California. Forest lands within the national parks and monument are not managed for timber production. The National Park Service preserves the natural and cultural resources found in each unique park setting. As with National Forest lands, the management decisions with the greatest potential to influence a future wolf population are related to public access.

State and Private Lands: Forest management on state and private conifer forest lands in California is regulated by the California Forest Practice Rules (FPRs) (Title 14, California Code of Regulations, chapters 4, 4.5, and 10) which implement the Z'berg-Nejedly Forest Practice Act. The FPRs require Registered Professional Foresters to prepare Timber Harvesting Plans (THPs), or similar documents (e.g. NTMPs) prior to harvesting trees on California timberlands. The preparation and approval of THPs is intended to ensure that potentially significant impacts to the environment are considered and, when feasible mitigated. Large blocks of contiguous industrial forest lands; particularly those with restricted public access, would be expected to be high quality wolf habitat should wolves become established in California. Public access policies vary by landowner and location.

Non-timber projects on state and private lands which are funded or authorized by public agencies are subject to the provisions of CEQA (e.g., highway construction, residential and commercial development, some energy projects). CEQA requires that actions which may substantially reduce the habitat, decrease the number, or restrict the range of any species which can be considered rare, threatened, or endangered (regardless of status under state or federal law) must be identified, disclosed, considered, and mitigated or justified (California Code of Regulations, Title 14, sections 15065(1), 15380). However, like the FPRs, there are no established guidelines or minimum conservation measures related to species impacts or their mitigation measures.

Sensitive Species Designations

State, federal and non-governmental organizations designate "at risk" species (e.g., threatened and endangered species, California Species of Special Concern, Species of Greatest Conservation Need) and assess and rank their conservation needs. Status designations for the gray wolf are summarized below for California, Oregon, and Nationwide (Federal):

State of California Status: The Fish and Game Commission designated the gray wolf as a "candidate" for listing as endangered or threatened under the California Endangered Species Act (CESA), effective November 2, 2012 (Cal. Reg. Notice Register 2012, No. 44-Z, p. 1610). Should the species not be listed under CESA, existing statutes classify the wolf as a nongame mammal (California Fish and Game Code section 4152) and subject to regulation under the authority of the Commission. Additionally, California law regulates the import and possession of wolves (CFGC section 2150, 2157, 6530, and California Code of Regulations Title 14, section 670). Because of its current federal listing status (see below), any gray wolves entering into California are considered a federally listed endangered species.

State of Oregon Status: Gray wolves are listed statewide as endangered in Oregon under the state's Endangered Species Act and protected under the Federal ESA in Western Oregon.

Federal Status: The gray wolf is currently listed as endangered throughout portions of its historic range, including California, under the Federal Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*)(ESA) wherever it has not recovered or has been determined to be an experimental population. However, the USFWS is currently in a public comment period through October 28 to consider their proposed rule to remove the gray wolf from the list of threatenede and endangered species, while explicitly identifying the Mexican wolf as an endangered species.

The Northern Rocky Mountains (NRM) gray wolf DPS was recently delisted in Montana, Idaho, Eastern Oregon, Eastern Washington, and North Central Utah due to meeting the recovery criteria of the NRM wolf recovery plan. Wolves that enter into California, and the western side of Oregon and Washington, are still protected by the ESA, which is administered and enforced by the USFWS. Under the ESA, the USFWS has lead responsibility for wolves in California. The Great Lakes gray wolf DPS has also been recovered and is currently delisted.

For species listed as endangered under the Federal ESA, activities that may result in "take" of the species are prohibited. The ESA defines "take" to mean "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."

MANAGEMENT RECOMMENDATIONS

The Department provides the recommendations below pursuant to FGC Section 2074.6 that directs the Department to include recommendations for management activities and other recommendations to aid in recovery of the species. However, the Department is currently leading the development of a California Wolf Plan, projected for completion in early 2015. This document will provide a comprehensive strategy for management of wolves in California for the future. Even though there currently are no wolves in California, the Department believes the following recommendations highlight actions that could help to conserve and manage gray

wolves in California if they become established in the state. Recommendations are based on scientific information on the gray wolf and are consistent with the possibility that wolves could enter and become established in California in the foreseeable future. These are preliminary recommendations based on information developed by Oregon, Washington, and USFWS for the NRM DPS. As new information becomes available, recommendations will be further refined. The recommendations are:

- Communicate to the public that natural dispersal of wolves into California is reasonable foreseeable given the expanding populations in the Pacific Northwest. Inform the public with science-based information on gray wolves and the conservation and management needs for wolves in California, as well as the effects of having wolves in the State.
- If and when wolves establish in California, seek to conserve self-sustaining populations of wolves in the State
- Manage native ungulate populations in the State to provide abundant prey for wolves and other predators, intrinsic enjoyment by the public and harvest opportunities for hunters
- Manage the distribution of wolves within the State where there is adequate habitat
- Prevent the construction of, or eliminate, barriers that would restrict the movement of wolves or their prey in California.
- Implement large scale restoration and enhancement projects that would improve habitat quality and carrying capacity of native ungulates, primarily elk and deer.
- Develop management strategies in collaboration with livestock producers to monitor and minimize wolf-livestock conflicts
- Develop an education and outreach plan to promote public understanding of wolves and wolf conservation. Present key facts on public safety, livestock depredation, and emerging wolf science.
- Prioritize projects that conserve large tracts of land consisting of continuous, diverse forest habitats throughout Northern and Northeastern California.

Comment [DEJ11]: Look again at the track or OR-7 (or any dispersing wolf or wolf pack) and tell me again what the barriers are.

Comment [DEJ12]: In my opinion you have over-emphasized specific vegetative community habitat requirements for wolves. As you mentioned on page 11 of this document"wolves are habitat generalists" and their "primary habitat requirements are the presence of adequate ungulate prey and water". It appears that you are advocating for control of extensive landscapes.

SCIENTIFIC DETERMINATIONS REGARDING THE STATUS OF THE GRAY WOLF IN CALIFORNIA

California law directs the Department to prepare this report regarding the status of the gray wolf in California based upon the best scientific information. Under the pertinent regulation, a "species shall be listed as endangered or threatened ... if the Commission determines that its continued existence is in serious danger or is threatened by any one or any combination of the following factors: (1) present or threatened modification or destruction of its habitat; (2) overexploitation; (3) predation; (4) competition; (5) disease; or (6) other natural occurrences or human-related activities." (Cal. Code Regs., tit. 14, § 670.1, subd. (i)(1)(A).)

Also key from a scientific standpoint are the definitions of endangered and threatened species, respectively, in the Fish and Game Code. An endangered species under CESA is one "which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, over exploitation, predation, competition, or disease." (Fish & G. Code, § 2062.) A threatened species under CESA is one

"that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts required by [CESA]" (*Id.*, § 2067).

The Department's scientific determinations regarding these factors as informed by, and following, independent peer review are summarized below. Because there is no current known population of gray wolves, or at the time of this status review, even a single known gray wolf in California, and because there is very little scientific knowledge available regarding historical populations that may have occurred in the state, all threats discussed are considered potential in nature. While the Department is identifying these factors, the actual significance of each as a real threat cannot be determined at this time.

1) Present or Threatened Modification or Destruction of Habitat
   - Modification or destruction of suitable denning and foraging habitat by human development (e.g. logging, or mining activities).
   - Increased human access and fragmentation of suitable habitat from new road construction.
   - Modification or loss of suitable denning and foraging habitat, and associated prey species from wildfire.
   - Native ungulate habitat reduction in habitat quality and quantity due to non-native plant species, competition with other herbivores (wild horses, domestic livestock), fire suppression, catastrophic wild fires, broadscale herbicide application for conifer release, loss of early seral forest habitat conditions due to absence of natural disturbances (natural fire regimes, promotion of late seral forest types)

2) Overexploitation
   - Threat of unnecessary human exploitation of wolves due to fear for personal safety.
   - Threat of human exploitation of wolves due to fear, or of loss of personal property (such as pets/livestock) or poaching.
   - Disturbance from ecotourism and other recreation in wolf denning and foraging habitats.

3) Predation
   - Predation on wolves by other wildlife species would not be expected to be a significant factor influencing wolves California.

4) Competition
   - Competition with mountain lions, bobcats, black bears, and coyotes influencing prey availability and distribution.
   - Harvest of elk and deer through sport hunting.

5) Disease
   - Risk to colonizing populations due to a zoonotic disease event (e.g., rabies, parvovirus, canine distemper).
   - Risk of the transfer of diseases between domestic animals and wolves.

Comment [DEJ13]: How do you identify suitable denning sites in areas that may be 500 square miles or larger?

As you go through this this section it appears to be a laundry list factors that may or may not be important for successful wolf populations. It looks like you are over-reaching. If you look at wolf expansion and population growth in the western US since reintroduction, you can easily see that wolves are very resilient and adaptive. They have expanded rapidly into many different habitat types and populations are growing.

I seriously doubt that you will have any trouble supporting wolves if the wild ungulate prey base is adequate and people are generally tolerant of wolves.

6) Other Natural Occurrences or Human-related Activities

- Risk of mortality due to roads, highways and expressways.
- Dispersal barriers to movement, genetic exchange, pair establishment, and territory occupancy.
- Risks inherent to small populations.

The Department is not applying these potential threats to make any inferences toward the gray wolf (Mexican wolf) that occurs in the Southwest. Because the likelihood of this animal inhabiting California is so remote, the Department's only finding is that there is no scientific information to support a status review.

Summary of Key Findings

Under the protections afforded by the Federal Endangered Species Act and the reintroduction recovery efforts since 1994, wolves are recolonizing portions of their historical range. The population has recovered in the Northern Rocky Mountains and has provided a source population for the edges of their range that is now being repopulated. Washington and Oregon have newly established populations that are expanding rapidly and making progress toward recovery goals. Oregon wolf recovery and management strategies describe population establishment statewide, and in time, establishment of wolves in California is considered possible. The habitat and prey base in California may be able to support a wolf population, based on habitat similarities with Oregon and the species' demonstrated adaptability for using a variety of habitats and prey species, but this remains uncertain, particularly with lower elk and deer densities in California. There currently is no wolf population in California for which to assess range, abundance, population trend, suitable habitat, or the potential threats.

Wolves are adaptive in prey selection and can occupy a variety of habitat types as long as they can find remote areas to reproduce without human disturbance. Although wolves prefer elk when available, they will opportunistically take other large ungulates, other carnivore species, or smaller prey. The number of wolves that could ultimately be supported in California is unknown, as would be their impact on the prey populations and other wildlife species in California's ecosystems. Given the current expansion of wolves, and the growth of the wolf packs in Oregon, it is reasonably foreseeable that wolves will disperse into California and eventually establish reproducing packs The Department is currently in the process of developing a California Wolf Plan with the primary goal of providing for the long-term conservation and management of wolves in the state once they establish a population or packs in California.

A key finding is that the gray wolf is not currently facing or enduring any threat in California at this time. However, the primary threats that will face the gray wolf in California will likely be managing cohabitation with humans where there is a fear for personal safety, a threat to personal livelihood, or both; and the availability of suitable habitat and prey. Other threats that feasibly could affect colonizing wolves and sustainable wolf populations include limited competition, disease, small population size, limited genetic diversity, habitat fragmentation, road kill, human exploitation and other human disturbances. However, as seen since 1995 in

the western U.S., wolves are a resilient species and can increase in numbers where adequate habitat and prey are available.

LISTING RECOMMENDATION

In consideration of the scientific information contained herein, the Department has determined that the petitioned action is/is not warranted at this time.

PROTECTION AFFORDED BY LISTING

In the absence of gray wolf in California, listing would provide no protection to the species. The following is a discussion of potential protection that could be afforded to the gray wolf in California if listed under CESA. While the protections identified in this section would help to ensure the future conservation of wolves if and when they enter the state, significant protections are now in place and would continue if the wolf were not listed under CESA. These include its current federal status, the focus on long-term conservation and management through the development and implementation of the California Wolf Plan currently underway, current CEQA requirements, and existing laws and regulations that make it illegal under State law to take wolves in California.

Protection under CESA

It is the policy of the State to conserve, protect, restore and enhance any endangered or any threatened species and its habitat. (Fish & G. Code, § 2052.) The conservation, protection, and enhancement of listed species and their habitat is of statewide concern (Fish & G. Code, § 2051(c).) As noted earlier, CESA defines "take" as hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill. (*Id.*, § 86.) Any person violating the take prohibition would be punishable under State law. As to authorized take, the Fish and Game Code provides the Department with related authority under certain circumstances. (*Id.*, §§ 2081, 2081.1, 2086, 2087 and 2835.) When take is authorized through an incidental take permit the impacts of the must be minimized and fully mitigated, among other requirements.

Increased protection of gray wolves following listing would also occur with required public agency environmental review under CEQA and its federal counter-part, the National Environmental Policy Act (NEPA). CEQA and NEPA both require affected public agencies to analyze and disclose project-related environmental effects, including potentially significant impacts on endangered, rare, and threatened special status species. Under CEQA's "substantive mandate," for example, state and local agencies in California must avoid or substantially lessen significant environmental effects to the extent feasible. With that mandate and the Department's regulatory jurisdiction generally, the Department expects related CEQA and NEPA review will likely result in increased information regarding the status of gray wolves in California as a result of, among other things, updated occurrence and abundance information for individual projects. Where significant impacts are identified under CEQA, the Department expects project-specific required avoidance, minimization, and mitigation measures will also benefit the species. While both CEQA and NEPA would require analysis of potential impacts to wolves regardless of their listing status under CESA, the acts contain specific requirements for analyzing and mitigating impacts to listed species. In common practice, potential impacts to listed species are examined more closely in CEQA and NEPA documents than potential impacts

to unlisted species. State listing, in this respect, and required consultation with the Department during state and local agency environmental review under CEQA, is also expected to benefit the species in terms of related impacts for individual projects that might otherwise occur absent listing.

If the gray wolf species is listed under CESA, it may increase the likelihood that State and Federal land and resource management agencies will allocate funds towards protection and recovery actions. However, funding for species recovery and management is limited, and there is a growing list of threatened and endangered species.

Preparers

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Consideration of Public Comments

The following is a summary of the comments received since the gray wolf was advanced to candidacy in October 2012. The Department issued a public notice seeking information related to the status of the gray wolf in California. The letters and input received is available for review at the Department of Fish and Wildlife, 1812 Ninth St., Sacramento. Comments submitted were evaluated for any scientifically-based information that would inform the Department as it related to this status assessment of the gray wolf in California.

Letters in Support of Listing

J. Capozzelli (letter) – April 22, 2013
Battle Creek Alliance (letter) – May 5, 2013
Society for Conservation Biology (letter) – May 6, 2013
California Wolf Center (letter and 147 scientific documents) – May 6, 2013
Center for Biological Diversity (letter) – May 6, 2013
The Humane Society of the United States (letter) – May 6, 2013
Project Coyote/Animal Welfare Institute (letter) – May 6, 2013 support listing
Public Interest Coalition – May 6, 2013 (letter)
Christina Eisenberg, PhD, (letter) – May 6, 2013
>6,000 emails supporting listing

Letters Not in Support of Listing

Jack Griffiths (letter) March 9, 2013
County of Lassen, California (Resolution) April 17, 2013
California Farm Bureau Federation, California Cattlemen's Association, and California Wool Growers Association (letter & research article) – May 6, 2013
<100 emails opposed to listing

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Lee, Rhianna@Wildlife

Subject: FW: Gray Wolf Petition (California Endangered Species Act) - Status Review for California
Attachments: CFW.doc; ATT00001.htm

From: Bob <rwayne@ucla.edu>
Date: November 20, 2013, 10:23:49 AM PST
To: "Loft, Eric@Wildlife" <Eric.Loft@wildlife.ca.gov>
Subject: Re: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Dear Eric,

I attach some comments, but I have to admit that I am not sure how useful they will be to you and your staff. I thought this report would deal with delisting questions, rather than only the status, which is a little hypothetical at this point since they are no wolves in California and historical information is scant and sketchy. The preliminary genetic data we have suggests only that the Mexican wolf was present in Southern California, and that other historic California haplotypes are similar to Canadian and Rocky Mountain wolves. The perhaps less expected finding is the presence of BC coastal wolf haplotypes in historic wolves from Oregon and in the present-day population in Washington State. I think this form does not fall under the current DPS (they are sometimes called "rain wolves" and live in coastal rainforest environments from Vancouver Island to Southeast Alaska and differ from inland Rocky Mountain wolves). This wolf variety perhaps deserves recognition as taxon of special concern. Something to think about given the chance of lawsuits from environmental organizations. We are working on getting our new genetic findings submitted for publication so they will be more directly useful to you. Please let me know if I can help in other ways.

Best regards,

Bob
On Oct 18, 2013, at 12:12 PM, Loft, Eric@Wildlife wrote:

Dear Dr. Wayne,

Thanks for your tentative agreement to review the subject document attached here (WORD document plus PDF of appendix/figures). Please review the attached letter (PDF) describing our intent, purpose, and request of you as a reviewer. I understand that plans may change and you may not be able to review the document for us. If that is the case please let me know as soon as practical. Otherwise, thank you very much in advance for your expertise and insight regarding the document.

Please contact me by email or telephone if you have any questions/concerns about this effort.

Sincerely,

Eric

Eric R. Loft, Ph.D, Chief
Wildlife Branch

California Department of Fish and Wildlife
1812 Ninth Street, Sacramento, CA 95811
(916) 445-3555; eric.loft@wildlife.ca.gov
Web: www.wildlife.ca.gov

From: Bob [mailto:rwayne@ucla.edu]
Sent: Thursday, September 26, 2013 11:17 AM
To: Loft, Eric@Wildlife
Subject: Re: Gray Wolf Petition (California Endangered Species Act) - Status Review for California

Dear Eric,

I would be happy to help.

Bob Wayne
UCLA
On Sep 26, 2013, at 2:03 PM, "Loft, Eric@Wildlife" <Eric.Loft@wildlife.ca.gov> wrote:

Review of "A Status Review of the Gray Wolf (*Canis lupus*) in California"

In this status report, the taxonomy, natural history and ecology of wolves is reviewed with a focus on California and the Pacific Northwest. The report also discusses some of the problems and challenges with wolf restoration in California. In general, this is an accurate summary, although it is plagued by the lack of historical information about wolves in California and therefore must be used cautiously for management. Moreover, there is over reliance on information from early wolf research and in places, the report should be updated with newer information from more recent research on Yellowstone wolves which has more similarity to the future situation in California.

Specific points:

1. Systematics. A problem with the systematics of Pacific Coast wolves is that the taxonomy is dated and most treatments derive from the original morphologic work done by Goldman (1944) over 80 years ago. The definition of appropriate conservation units for conservation, especially for highly mobile species such as the gray wolf, has advanced considerably since then (e.g. Funk et al., 2012; Crandall et al., 2000; Moritz, 1994). Even recent treatments such as Chambers et al. (2012) merely reviews past studies and attempts to develop a consensus of historical taxonomic treatments. For conservation units, such as the DPS, definitions need to based on the most current scientific thinking. There is abundant literature largely ignored by Chambers et al. suggesting wolf populations are structured by ecology and identifies West Pacific Coast, central Rockies and Mexican wolf genetic units (Fig. 1; Geffen et al., 2004; Carmichael et al., 2007; Musiani et al., 2007; Munoz-Fuentes et al., 2009; vonHoldt et al. 2011). Moreover, the taxonomic conclusions of the Chambers et al. paper are controversial, at least in my opinion and there are very few morphologically based systematists left that study taxonomy below the species level in carnivores. Nowak was among the last from the morphological tradition who studied wolf taxonomy, and the tools and phenetic approach he used date to the 1960s.

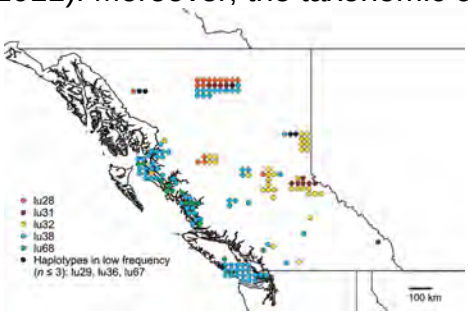

Figure 1. Distribution of the coastal haplotype in BC wolves indicated by the blue colored dots.

Genetic data largely do not support past wolf subspecies definitions and hence any conclusions made from the historical morphologically based taxonomy are tenuous at best.

Our preliminary genetic analysis of historic specimens from the West Coast suggests at least the Mexican wolf and Rocky Mountain wolf existed historically in California, although this is based on a small sample size. Both the Rocky Mountain wolf and Coastal wolf haplotypes are currently found in the extant Washington and Oregon population, representing migration from Idaho

and British Columbia. Historically, we have identified three individuals with Coastal haplotypes in historic specimens from Oregon, suggesting the present of the Coastal wolf there before extirpation, and the likelihood that they existed in California and Washington given the dispersal abilities of wolves and the presence of suitable habitat at that time. If the goal of restoration is to return past patterns of diversity to the US Pacific coast, the re-established wolf population in California should contain contributions from all three entities. Finally, of these three entities, only the Rocky Mountain wolf is part of the western DPS, the Mexican wolf is a listed entity and the coastal BC wolves have not been formally considered under the current USFWS wolf delisting plan.

2. Factors affecting the ability of the gray wolf to survive and reproduce. This is good list. However, I think dog-wolf interactions (including predation and hybridization) needs to be discussed as well. I think the California model for wolves may be closer to that in Italy, where limited abundance of natural game and high human densities have brought wolves in close contact with humans. This human contact is enhanced by the presence of livestock, carcasses or garbage. Hybridization has been common in Italy with the formation of mixed packs. The extent of hybridization will depend on the size of the wolf population and their distribution in California.

3. Prey availability and competition. Here and elsewhere, the affect of gray wolves is viewed as largely negative. This view is somewhat contradicted by a body of recent evidence showing ecosystem benefits to wolf reintroduction, the so-called tropic cascade. For example, new evidence suggests bears actually benefit from wolves through the increased number of carcasses, as do ravens and other carnivores (Ripple et al., 2013). The diminished grazing pressure by ungulates resulting from wolf predation allows the regrowth of trees, and restoration of historical habitats. Wolves also change the tropic structure of the carnivore community, reducing the abundance of coyotes, which are a major predator of livestock and allow smaller carnivores, such as red foxes, to increase in number. The report needs to incorporate and comment on this literature. I think it is a critical void in the current treatment, and biologists such Chris Wilmer at UCSC could be consulted.

I am uncertain why the authors of the report believe there is not sufficient prey density of deer to support wolves. This needs to be clarified.

4. Small population size. There are two distinct models for wolves in California, one passive and the other proactive. The first is the current situation, where a wolf or two may visit infrequently, but packs are not readily established because the habitat is not suitable, mortality is high, or the number of migrants is so low that individuals cannot find mates. This may become more likely if Oregon strongly limits their wolf populations and will entail genetic loss through small population size, inbreeding and low levels of gene flow. The second is that wolves are established in greater number, perhaps assisted by translocation from

Oregon, into areas of abundant game and low conflict. This is more like the Yellowstone model where 34 wolves were translocated from sites in Canada. Wolves that migrate naturally in California could perhaps be moved to these pre-designated areas to enhance genetic diversity. The latter model takes a proactive stance and attempts to manage the recolonization of wolves to reduce conflict and enhance success. In contrast, the former passive model may increase the potential for conflict and establishment of wolves in inappropriate areas.

5. Disease. Mange is potentially a greater concern than mentioned since it is now devastating the wolf population in Yellowstone. One potential threat that is not mentioned is anticoagulant poisoning that is a problem for coyotes and bobcats statewide and has even killed mountain lions in Los Angeles.

6. Over-exploitation. Successful restoration of wolves in California will likely result in a managed hunt as it has in other states. However, there is very little treatment of this issue in the report. If hunting is not allowed because of public pressure as for the mountain lion, it will likely be a problem for management. I would think the State would like to consider this problem in the report more thoroughly.

7. Wolf conservation and management. Until the state develops a plan for the wolf, it is hard to comment on this section.

8. Summary of key findings. The number of wolves that could be supported. I am surprised that some rough estimation of wolf abundance historically in California was not attempted. If there are 4000-6000 mountains today, wouldn't we expect the historic number of wolves to be at least that large?

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Lee, Rhianna@Wildlife

Subject: FW: Wilson_Review attached
Attachments: Wilson_SM_Status Review Comments_Nov. 21_2013.docx

From: Seth Wilson [mailto:swilson@bigsky.net]
Sent: Friday, November 22, 2013 10:50 AM
To: Loft, Eric@Wildlife
Subject: Wilson_Review attached

Hi Eric:
Please find my review attached. Please let me know if I can be of any future service or if you have any questions about my review. Any feedback that you might have or be willing to provide me is always appreciated.

Please know that I am interested in the situation in N. California if/when wolves recolonize. I have spent much of my professional career working on how to reduce conflicts among people and large carnivores. More recently, we've had to grapple with the huge challenges of living with wolves here in Montana. I am currently focusing much effort on reducing livestock losses to wolves and have built strong working relationships with Montana's agricultural community over the past 20 years.

As your situation evolves, please don't hesitate to be in touch—we worked closely with Phil Andersen at WDFW and he and his top leadership team spent a couple of days at our project site in the Blackfoot Valley to learn about our comprehensive approach to mitigating wolf-livestock conflicts. It's been great to work with them. Some of the emerging range rider work that they are doing in Eastern WA (using GPS) is really interesting and I've been over in WA to learn from them—so it's a cross-fertilization partnership that is emerging. Anyway, I guess this is my long winded way of saying that if there are opportunities to collaborate, I've found it really helpful all the way around. Good luck with the wolf situation and I hope we stay in touch.

BEST wishes and I hope you have a great Thanksgiving,

Seth

Seth M. Wilson, Ph.D.
Visiting Fellow, Yale University - School of Forestry and Environmental Studies
Program Coordinator, Blackfoot Challenge - Wildlife Committee
People & Carnivores Program, Northern Rockies Conservation Cooperative
Team Member, International Union for the Conservation of Nature (IUCN) Human-Bear Conflict Specialist Group
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e-mail: swilson@bigsky.net

November 22, 2013

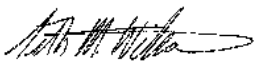
Dear Dr. Loft:

I have read and reviewed the *Status Review of the Gray Wolf in California*. I found the review to be generally well researched and appropriately cited. Please note that my expertise and research as a conservation biologist has largely focused on grizzly bears (*Ursus arctos*) and spatial modeling of human-bear conflict risk. Nonetheless, I have been working on wolf-livestock conflict mitigation efforts for the past seven years in Montana, Canada, and the Northwest and I'm generally familiar with wolf related literature and key issues related to wolf management and conservation.

Overall, I found the review to be a straightforward treatment the current situation in California. I have several specific comments regarding: 1) Potential wolf habitat suitability models, 2) literature pertaining to trophic cascades, 3) general questions, 4) minor questions on appropriate use of citations, and 5) minor grammatical edits.

Thank you and the California Department of Wildlife for the opportunity to take part in the review. I wish you and your department colleagues all the best for the future when/if wolves recolonize California.

Sincerely,



Dr. Seth Wilson

Review

Habitat Suitability Models:
Pg. 11 lines 28-45: I am curious why the Carroll map outputs were not displayed in the report? Since modeling is an intrinsically uncertain endeavor, it may be useful to rely on multiple models and look for general agreement with respect to wolf habitat prediction in California.

Pg. 43, lines 43-45: The authors suggest that the Oakleaf model was "subsequently validated in 2010 with respect to wolf survivorship." Please provide more specific methods as to how model validation was specifically carried out.

Pg. 44, line 44: The authors state that the Oakleaf model is based on fewer assumptions than other models and implies that this makes it better. Can we safely assume this? What other specific models are the authors referring to? Generally, I would agree that parsimony should always be a goal of a modeler, but the complexity of assumptions, not necessarily the number of assumptions should be considered as well and may be relevant in this case.

It would likely be appropriate to mention ALL potential wolf habitat model efforts that have been conducted and discuss them in this status review—this way you have been more comprehensive. The 2001 Carroll model (map) would be useful to compare with Oakleaf and have in this status review.

Trophic Cascade Literature:
Pg. 9, lines 9-13: Authors should mention that: 1) there are extensive debates in the trophic cascade hypothesis literature regarding the *relative influence* of wolves on trophic levels (specifically how strong and effect wolves may have on vegetative release. And 2) it should be mentioned that while wolves can have indirect effects on habitat conditions, those effects are ecologically context-specific as mitigated by fire, drought, and climate at various scales. There is an abundant literature here that could be reviewed and mentioned (briefly) in this status review. I have included some of those references—**please NOTE:** I had a student intern compile some of the recent literature on tropic cascades. He made minor formatting errors (capitalization and others) in the actual citation list (Appendix A) but it may be helpful to your staff at CDFW in terms of simply identifying some relevant literature.

General Questions:
I found Appendix A to be well researched, yet I wonder if there are additional historical data that can be found? With the extensive history of mining in California, are there miners' journals or early accounts by mining survey crews that might have observed wolves?

I found this citation (Schmidt, 1991) while conducting my review. While I have not had the time to read this, it would seem quite useful to include in this status review?

Schmidt, R.H. 1991. Gray wolves in California: their presence and absence. California Fish and Game, 77: 79-85.

Pg. 13, line 8: Potential wolf population growth rates in California will be factors of: habitat suitability, prey availability, **AND rates of human-caused mortality**. This last factor should be included.

Appropriateness of Citations:
Pg. 4, line 19: I suggest using a citation (regarding typical wolf weights in Montana) that is based on Montana wolf research, not a secondary reference from WA Dept. of Fish and Wildlife.

Pg. 15, line 10: I would suggest using a different reference here—specifically one that is a seminal treatment of wolf predation on mammals (and preferred prey size).

Minor Suggested Edits:
Pg. 4, line 26: list out those states of the Northern Rocky Mountain States.

Pg. 13, line 42: Word choice. Instead of "Human <u>Predation</u> on Wolves", insert "Human **Persecution** of wolves." Predation describes an interaction of a predator that seeks to or feeds on its prey. Unless this is the intended meaning the authors which to convey here, I would suggest a different word.

Pg. 14, lines 8-11: reported cattle losses should be presented over a time-frame. As it stands, the statistic has no context.

Pg. 22, line 13: Period is needed at the end of the bullet.

Pg. 22, line 16: See above.

Pg. 22, line 22: See above.

Pg. 22, line 25: Remove extra period.

Pg. 23, line 23: Period is needed.

Pg. 24, line 40: Other threats to sustainable wolf populations in California will likely be wolf removals (lethal control) **due to wolf-livestock conflicts**. That factor should be included in this section.

Pg. 25, line 5: Change wolf to wolves.

Appendix A: Select literature on tropic cascades and wolves.

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