32. MOUNTAIN LION CESA PETITION

Today's Item **Information ☐** **Action ☒**

Consider whether listing certain population(s) of mountain lion (*Puma concolor*) as threatened or endangered under the California Endangered Species Act (CESA) may be warranted.

Summary of Previous/Future Actions

• Received petition	Jun 25, 2019
• FGC transmitted petition to DFW	Jul 5, 2019
• Published notice of receipt of petition	Jul 26, 2019
• Public received petition and FGC approved DFW's request for 30-day extension	Aug 7-8, 2019; Sacramento
• Received DFW's petition evaluation	Feb 21, 2020; Sacramento
• **Today determine if listing may be warranted**	**Apr 15-16, 2020; Teleconference**

Background

On June 25, 2019, the Center for Biological Diversity and the Mountain Lion Foundation (petitioners) submitted a petition to list an evolutionarily significant unit (ESU), comprised of six populations of mountain lion in southern and central coastal California, as threatened or endangered under CESA (Exhibit 1). The petition requests that, if the requested ESU is rejected, other combinations of the six populations be considered. On Jul 5, 2019, FGC transmitted the petition to DFW for review. A notice of receipt of petition was published in the California Regulatory Notice Register on Jul 26, 2019.

California Fish and Game Code Section 2073.5 requires that DFW evaluate the petition and submit to FGC a written evaluation report with a recommendation, which was received at FGC's Feb 2020 meeting (exhibits 2-3). The report delineates each of the categories of information required for a petition, evaluates the sufficiency of the available scientific information for each of the required components, and incorporates additional relevant information that DFW possessed or received during the review period. Based upon the information contained in the petition and other relevant information, DFW has determined that there is sufficient scientific information available to indicate that the petitioned action may be warranted.

At today's meeting, FGC will receive a presentation on DFW's petition evaluation and hold a public hearing on the petition to receive information and oral testimony consistent with the requirement in Fish and Game Code Section 2074.2. Today's agenda item occurs more than 30 days after the public release and review period of the evaluation report prior to FGC action, as required in Fish and Game Code Section 2074. If FGC determines listing may be warranted pursuant to Section 2074.2(e) of the Fish and Game Code, DFW will undertake a one-year status review before FGC can make a final decision on listing.

CESA and FGC's listing regulation require that the petition contain specific scientific information related to the status of the species. CESA, and case law interpreting it, make clear that FGC must accept a petition when the petition contains sufficient information to lead a

reasonable person to conclude that there is a substantial possibility the requested listing could occur; the requested listing is tied to the species' status, that is, whether the species' continued existence is in serious danger or is threatened by a number of factors, and does not relate to economic consequences that might result from listing.

If FGC determines that the petitioned action may be warranted, the ESU of mountain lion identified in the petition would be a candidate species pursuant to Section 2074.2. Candidate species are protected under the ESA pursuant to Section 2085 during the remainder of the CESA listing process.

Significant Public Comments

1. State senators Henry Stern and Ben Allen and assembly members Richard Bloom, Laura Friedman, and Kevin Mullen write to urge protections for mountain lion and recommend FGC advance the petition. The legislators cite the death of an important lion and recount habitat connectivity concerns (Exhibit 4).
2. Friends of Animals, Grassroots Coalition, the Airport Marina Group of the Sierra Club, the Puente Hills Habitat Preservation Authority, and the Friends of Griffith Park support the actions and recommendations in the petition, citing habitat fragmentation and other threats as well as the mountain lion's importance as an apex predator (see Exhibit 5 for a sample).
3. A task force of the Sierra Club, Angeles Chapter urges FGC to accept DFW's recommendation, citing lack of genetic diversity and highlighting its work on habitat connectivity (Exhibit 6).
4. The Midpeninsula Regional Open Space District supports the petition and calls attention to similarities and differences between the Santa Cruz Mountain (SCM), Santa Ana Mountain (SAM), San Gabriel/San Bernadino Mountain, and the Santa Monica Mountain populations. The district provides further details on the SCM population, district initiatives to address human-wildlife conflicts, research needs, and depredation issues. The district includes a literature review for its Wildlife and Livestock Protection Policy (Exhibit 7).
5. Rancho Mission Viejo explains how the Southern Subregion Habitat Conservation Plan (HCP) provides habitat-based protections in Orange County, as mountain lion is specifically considered by the plan and occupies virtually the entire area. The ranch provides further details on the planning regime, populations, habitat, and conservation activities in the area, believing the HCP adequately addresses the needs of mountain lion within its portion of the Santa Ana Mountains population. The district asks that, if mountain lion is listed as a candidate species, the HCP be recognized as contributing to the protection and management of the Santa Ana Mountains population (Exhibit 8).
6. Assembly Member Frank Bigelow expresses concern for the ability of livestock owners to obtain depredation permits if mountain lion becomes a candidate species, urges a "determination that no action is warranted," and urges a delay in FGC's decision to allow greater participation by constituents with limited Internet access (Exhibit 9).
7. On behalf of several ranchers and farmers, a firm requests that FGC postpone a decision until a more comprehensive estimate is made of mountain lion numbers throughout the state. The group takes issue with the "50/500 rule" as outlined in the

petition, asserts that the Central Coast population is viable, questions the validity of ESUs for mountain lion, and states that management actions are already available to mitigate low genetic diversity (Exhibit 10).

8. Eleven letters from members of the California Cattleman's Association recount the dangers to human safety and livestock posed by mountain lions, lament the loss of deer due to mountain lions, question the assessments of low mountain lion numbers, explain differences between central and southern California populations, and defend their ability to apply for depredation permits (see Exhibit 11 for an example letter).
9. A commenter urges the Ventura County Board of Supervisors to vote against a resolution "to end the issuance of depredation permits in Ventura County for mountain lions that attacked livestock and other animals" and to support "legislative or executive action to support the listing of the Southern /Central Coast Evolutionarily Significant Unit (ESU) of Mountain Lions," making reference to depredations in Ventura County (Exhibit 12).
10. On behalf of several ranchers and farmers in the central coast and Central Valley, a law firm states that the petition would be in direct conflict with, and result in unconstitutional amendments to, the initative statute known as Proposition 117, and concludes that FGC is "without any discretion other than to deny the Petition", providing a legal analysis to support its conclusion (Exhibit 13).
11. The California Cattleman's Association, the California Chamber of Commerce, the California Farm Bureau Federation, the Rural Counties Representatives of California, and the Monterey County Farm Bureau ask to delay the "may be warranted" decision, citing COVID-19 concerns and the ability for the public to comment (exhibits 14-15).
12. Over 1000 similar letters of support for listing mountain lion (see Exhibit 16 for a sample).

Recommendation

FGC staff: Determine that listing may be warranted.

DFW: Accept and consider the petition for further evaluation.

Exhibits

1. CESA petition, received Jun 25, 2019
2. DFW memo transmitting 90-day evaluation report, received Feb 6, 2020
3. DFW 90-day evaluation report
4. Letter from state senators Henry Stern and Ben Allen and assembly members Richard Bloom, Laura Friedman, and Kevin Mullin, received Apr 2, 2020
5. Letter from Courtney McVean, Friends of Animals, received Mar 27, 2020
6. Letter from Joan Licari, San Gabriel Valley Task Force of the Angeles Chapter of the Sierra Club, received Mar 30, 2020
7. Letter and literature review from Kirk Lenington, Midpeninsula Regional Open Space District, received Apr 1, 2020
8. Letter from Laura Coley Eisenberg, Rancho Mission Viejo, received Mar 30, 2020

9. Letter from Assembly Member Frank Bigelow, received received Mar 19, 2020 and email from Hannah Ackley on behalf of Assembly Member Frank Bigelow, received Apr 1, 2020
10. Letter from Adrian Juncosa, EcoSynthesis Scientific and Regulatory Services, Inc., received Apr 2, 2020
11. Emails received from Kirk Wilber, California Cattlemen's Association, transmitting 9 letters from members, received Mar 31, 2020 and Apr 2, 2020
12. Letter from Misty McNamara, received Feb 24, 2019
13. Letter from Pamela H. Silkwood, Horan Lloyd Attorneys at Law, received Apr 2, 2020
14. Letter from the California Cattlemen's Association, California Chamber of Commerce, California Farm Bureau Federation, and Rural Counties Representatives of California, received Mar 26, 2020
15. Letter from Norman C. Groot, Monterey County Farm Bureau, received Mar 31, 2020
16. Email from Lisa Levinson, received Mar 23, 2020
17. DFW presentation

Motion/DirectionMotion/Direction

Moved by _____ and seconded by _____ that the Commission, pursuant to Section 2074.2 of the Fish and Game Code, finds the petition to list one or more evolutionarily significant units of mountain lion as an endangered or threatened species **does** provide sufficient information to indicate that the petitioned action **may be** warranted based on the information in the record before the Commission, directs staff to issue a notice reflecting this finding, and declares, within the southern ESU, mountain lion is a candidate for threatened or endangered species status.

OR

Moved by _____ and seconded by _____ that the Commission, pursuant to Section 2074.2 of the Fish and Game Code, finds that the petition to list one or more evolutionarily significant units of mountain lion as an endangered or threatened species **does not** provide sufficient information to indicate that the petitioned action may be warranted based on the information in the record before the Commission.

Tiemann, Sheri@FGC

From: Brendan Cummings <BCummings@biologicaldiversity.org>
Sent: Tuesday, June 25, 2019 12:10 AM
To: FGC
Cc: Tiffany Yap
Subject: Petition to list an ESU of mountain lions under CESA
Attachments: CESA petition - Southern California Central Coast Mountain Lions - Final 6 25 19.pdf

Acting Executive Director Miller-Henson and members of the Commission,

Please find attached a petition filed on behalf of the Center for Biological Diversity and the Mountain Lion Foundation to list an evolutionarily significant unit (ESU) of mountain lions (*Puma concolor*) in Southern and Central Coastal California as "threatened" or "endangered" pursuant to the California Endangered Species Act (CESA) (California Fish and Game Code §§ 2050 et seq.) and its regulations (Section 670.1, Title 14, California Code of Regulations). As demonstrated in the attached petition, mountain lions in these areas comprise an ESU (referred to as the "Southern California/Central Coast ESU") and meet the statutory definition of a "threatened species."

A hardcopy of the petition and a disk containing the cited references are also being sent to the commission today.

Please contact me or my colleague Tiffany Yap (the lead author of the petition, cc-ed and contact info below), if you have any questions or need further information.

Best,

Brendan

Brendan Cummings
Conservation Director
Center for Biological Diversity

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BEFORE THE CALIFORNIA FISH AND GAME COMMISSION

A Petition to List the Southern California/Central Coast Evolutionarily Significant Unit (ESU) of Mountain Lions as Threatened under the California Endangered Species Act (CESA)

A Mountain Lion in the Verdugo Mountains with Glendale and Los Angeles in the background. Photo: NPS

Center for Biological Diversity and the Mountain Lion Foundation

June 25, 2019

Notice of Petition

For action pursuant to Section 670.1, Title 14, California Code of Regulations (CCR) and Division 3, Chapter 1.5, Article 2 of the California Fish and Game Code (Sections 2070 *et seq*.) relating to listing and delisting endangered and threatened species of plants and animals.

I. SPECIES BEING PETITIONED:

Species Name: Mountain Lion (*Puma concolor*). Southern California/Central Coast Evolutionarily Significant Unit (ESU)

II. RECOMMENDED ACTION: Listing as Threatened or Endangered

The Center for Biological Diversity and the Mountain Lion Foundation submit this petition to list mountain lions (*Puma concolor*) in Southern and Central California as Threatened or Endangered pursuant to the California Endangered Species Act (California Fish and Game Code §§ 2050 et seq., "CESA"). This petition demonstrates that Southern and Central California mountain lions are eligible for and warrant listing under CESA based on the factors specified in the statute and implementing regulations. Specifically, petitioners request listing as Threatened an Evolutionarily Significant Unit (ESU) comprised of the following recognized mountain lion subpopulations:

1. Santa Ana Mountains
2. Eastern Peninsular Range
3. San Gabriel/San Bernardino Mountains
4. Central Coast South (Santa Monica Mountains)
5. Central Coast North (Santa Cruz Mountains)
6. Central Coast Central

Alternatively, as detailed in the petition, in the event the Commission determines that these six populations collectively either do not comprise a single Southern California/Central Coast ESU or otherwise do not meet the criteria for listing as Threatened, petitioners request the Commission consider whether any of these populations, singularly or in combination, comprise one or more ESUs and meet the criteria for listing as Threatened or Endangered pursuant to CESA.

III. AUTHORS OF PETITION:

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I hereby certify that, to the best of my knowledge, all statements made in this petition are true and complete.

Signature:  Date: 6/25/19

Table of Contents

Executive Summary

The Center for Biological Diversity and the Mountain Lion Foundation submit this petition to list mountain lions (*Puma concolor;* cougar, puma) in Southern and Central Coastal California as "threatened" or "endangered" pursuant to the California Endangered Species Act (CESA) (California Fish and Game Code §§ 2050 et seq.). Following Section 670.1, Title 14, California Code of Regulations, petitioners present scientific information regarding life history, population trend, range, distribution, abundance, kind of habitat necessary for survival, factors affecting the ability to survive and reproduce, degree and immediacy of threat, impact of existing management efforts, suggestions for future management, availability of sources and information, and a detailed distribution map.

Specifically, petitioners request listing as a "threatened species" an evolutionarily significant unit (ESU) comprised of the following recognized mountain lion subpopulations:

1. Santa Ana Mountains
2. Eastern Peninsular Range
3. San Gabriel/San Bernardino Mountains
4. Central Coast South (Santa Monica Mountains)
5. Central Coast North (Santa Cruz Mountains)
6. Central Coast Central

As demonstrated in this petition, mountain lions in these areas comprise an ESU (referred to as the "Southern California/Central Coast ESU") and meet the statutory definition of a "threatened species."

The California Fish and Game Commission has long recognized that ESUs can be designated and listed under CESA, and this interpretation of CESA has been upheld by the courts. *See California Forestry Assn. v. California Fish & Game Com.* (2007) 156 Cal.App.4th 1535, 1540 ("Consistent with the policy of the CESA, we will hold that the term 'species or subspecies' includes evolutionarily significant units"); *Central Coast Forest Assn. v. Fish & Game Com.* (2018) 18 Cal.App.5th 1191, 1197, fn. 4 [*"CCFA II*"] ("An ESU is included within the term 'species or subspecies' in sections 2062 and 2067."). While the ESU concept has primarily been applied to fish, the Commission recently listed an ESU of a mammal, the Pacific Fisher, as a "threatened species." *See* 14 C.C.R. 670.5(b)(6)(J) ("Fisher (*Pekania pennant*) Southern Sierra Nevada Evolutionarily Significant Unit").

Under CESA, a "threatened species" is "a native species or subspecies of a … mammal… that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts . . . ." Cal. Fish & Game Code § 2067. An animal is an "endangered species" when it 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, overexploitation, predation, competition, or disease." Cal. Fish & Game § 2062.

Certain populations of the Southern California/Central Coast mountain lion ESU are already "in serious danger of becoming extinct" (*e.g*. Santa Ana and Santa Monica mountains), and if assessed separately, would individually meet the definition of an "endangered species." When considered as a whole, the Southern California/Central Coast ESU is not at imminent risk of extinction but still faces significant and growing threats that ultimately threaten the viability of the entire ESU; it consequently meets the definition of a "threatened species."

Currently, there is no reliable estimate of mountain lion abundance in California. In 1984 the California Department of Fish and Wildlife (CDFW) estimated between 4,000-6,000 adult mountain lions in the state (Mansfield and Weaver 1984). However, CDFW acknowledges that this estimate is outdated and likely overestimates mountain lion abundance. CDFW is currently undertaking a large-scale research effort to estimate mountain lion numbers throughout California.

While reliable absolute abundance estimates are unavailable, recent genetic research has led to estimates of effective population size for California mountain lion populations.[1] These estimates highlight the genetic isolation among California mountain lion populations and raise significant concerns for the continued viability of mountain lions in Southern California and along the Central Coast.

Researchers have recently identified 10 genetically distinct mountain lion populations in California (Figure ES-1) (derived from Gustafson et al. 2018). Nine of these populations occur almost exclusively in California, while one is centered in Nevada but extends into the northeastern corner of California.

The abundance of mountain lions in the North Coast and inland populations (Western Sierra Nevada, Eastern Sierra Nevada, and the genetic cluster centered in the state of Nevada) is not well established; however, these populations are better connected than Southern California and Central Coast mountain lions, and they show relatively high levels of genetic diversity. Gustafson et al. (2018) suggest that these four populations may comprise an ESU. While these populations should be monitored and managed to ensure their continued viability, petitioners do not seek protection of these populations as an ESU under CESA at this time.

Considering the genetic source-sink dynamics among the remaining six populations, petitioners demonstrate that the populations along the Central Coast and in Southern California collectively comprise an ESU that warrants protection under CESA.[2] The Southern California/Central Coast ESU is comprised of six genetically distinct mountain lion populations: Central Coast North (CC-N, which includes mountain lions in the Santa Cruz Mountains and East Bay), Central Coast

[1] At its simplest, effective population size is the number of animals contributing offspring to the next generation. It is an important measure of the genetic health of a population.

[2] As explained *infra* at Section 3.0, these remaining populations can be grouped into one or several potential ESUs. Petitioners believe that for purposes of listing under CESA, treating them as a single ESU is supported by the best available science. Moreover, a single ESU also is the most pragmatic from a management perspective, as recovery of the individual populations ultimately depends upon maintaining and/or reestablishing connectivity between them. *See CCFA II,* 18 Cal.App.5th 1191, 1237 ("[T]he nature of the ESU designation is such that genetics alone are not determinative: One must look beyond genetics to questions of policy to determine which populations to include in an ESU.")(quotations omitted).

Central (CC-C), Central Coast South (CC-S, which includes the mountain lions in the Santa Monica Mountains), San Gabriel/San Bernardino Mountains (SGSB), Santa Ana Mountains (SAM), and Eastern Peninsular Range (EPR) (Gustafson et al. 2018).

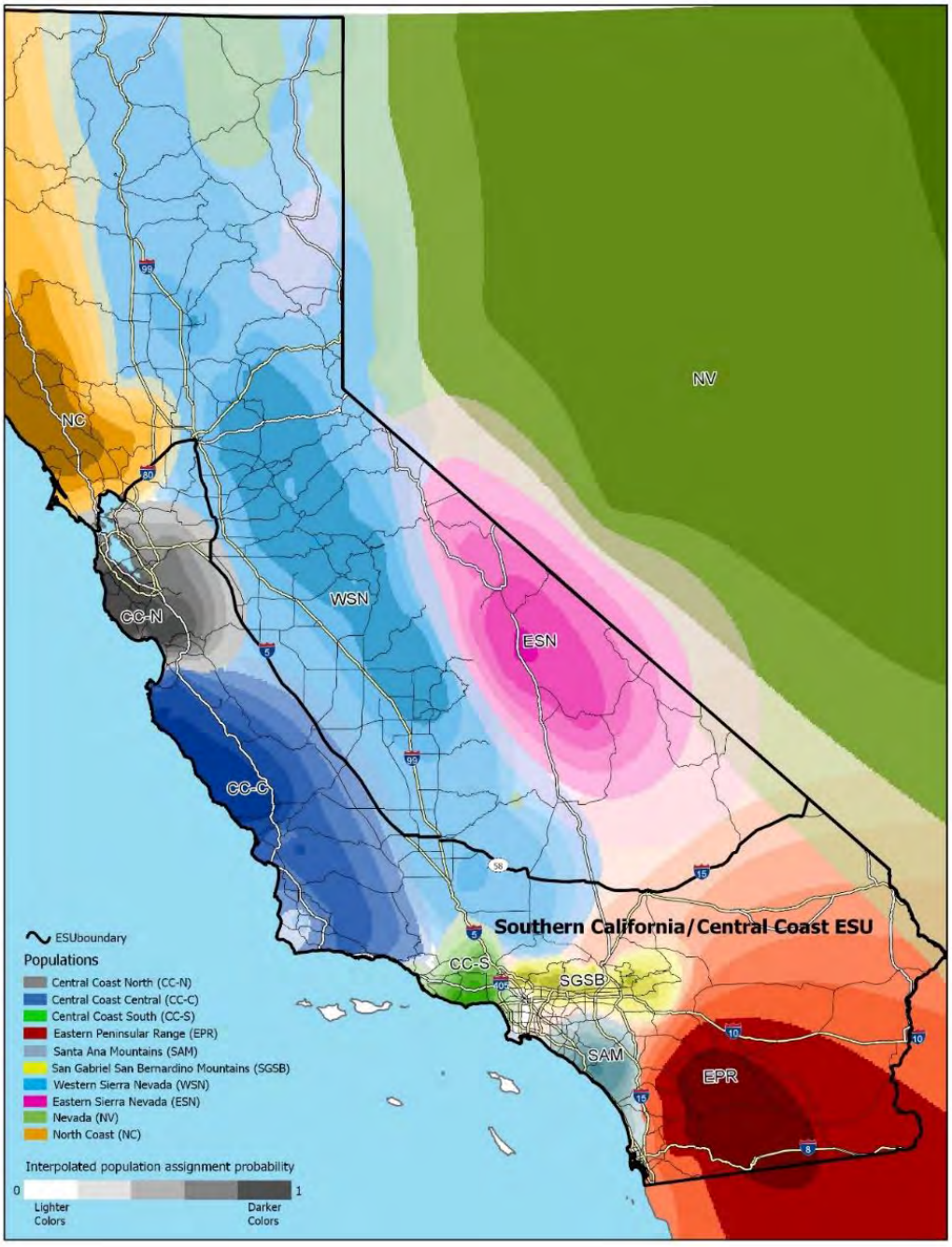

Figure ES-1. Map of genetically distinct mountain lion populations and major roadways in California based on data collected from 1992-2016 (the division and status of these populations could change over time and with further research). The black lines show the proposed Southern California/Central Coast ESU boundary. Derived from Gustafson et al. (2018). Genetics data source: Kyle Gustafson, PhD, Department of Biology and Environmental Health, Missouri Southern State University, and Holly Ernest, DVM, PhD, Department of Veterinary Sciences, Program in Ecology, University of Wyoming, Laramie. Roads data source: ESRI.

The boundary of the Southern California/Central Coast ESU is proposed in Figure ES-1, and includes mountain lions that occur south of the San Francisco Bay and I-80, west of I-5 to the intersection of I-5 and SR-58, south of SR-58 to I-15, south of the I-15 from the SR-58 intersection to the California-Nevada border, and, for the purposes of CESA, as far south as the California-Mexico border. These boundaries are recommended as they include virtually all mountain lions associated with the six populations comprising the ESU and are also unambiguous and readily discernable for purposes of management. We recommend including mountain lions in the Tehachapi and Sierra Pelona Mountains south of SR-58 in this ESU. While most mountain lions sampled from this region share some genetic affinities with Western Sierra Nevada (WSN) animals, many also show genetic connections with CC-S, SAM, EPR and SGSB mountain lions. This area serves not just as a connecting link between mountain lion populations comprising the Southern California/Central Coast ESU, but also between this ESU and all other California mountain lions and is therefore essential for the overall genetic health of mountain lions in the state.

While Southern California and Central Coast mountain lions face a multitude of threats, the greatest challenges stem from habitat loss and fragmentation and the consequent impact on their genetic health. Most of the populations comprising the ESU have low genetic diversity and effective population sizes, which puts them at increased risk of extinction (Ernest et al. 2003; Ernest et al. 2014; Riley et al. 2014; Vickers et al. 2015; Benson et al. 2016; Gustafson et al. 2018; Benson et al. 2019). The populations most at risk are the SAM, CC-S, SGSB, and CC-N populations. Due to extreme isolation caused by roads and development, the SAM and CC-S, populations exhibit high levels of inbreeding, and, with the exception of the endangered Florida panther, have the lowest genetic diversity observed for the species globally (Ernest et al. 2014; Riley et al. 2014; Gustafson et al. 2018; Benson et al. 2019). The SGSB and CC-N similarly have low observed genetic diversity and effective population sizes, and they reside in areas of significant isolation and habitat fragmentation, which also puts them at increased risk (Gustafson et al. 2018). And although the CC-C and EPR populations have slightly higher levels of genetic diversity and effective population sizes, high rates of development, habitat loss and fragmentation, and human-caused mortalities in both areas could lead to a similar fate of isolation, genetic drift, low effective population size, and increased risk of extinction in the foreseeable future.

Although minimum viable effective population size has been found to vary depending on the species (Frankham 1995; Traill et al. 2010), general conservation management practice over the past few decades has followed a 50/500 rule, under which an effective population size of 50 is assumed sufficient to prevent inbreeding depression in the short term (over the duration of five generations) and an effective population size of 500 is sufficient to retain evolutionary potential in perpetuity (Traill et al. 2010; Frankham et al. 2014). It is clear that Central Coast and Southern California mountain lion populations are genetically compromised and face significant risk of extinction in both the short- and long-term. Five of the six populations have effective population sizes well below 50 (from lowest to highest: CC-S, SGSB, SAM, CC-N, EPR), and one population (CC-C) is just barely above that threshold at $N_e = 56.6$ (Table ES-1) (Gustafson et al. 2018).

Table ES-1. Effective population size from Gustafson et al. (2018) and estimated total adult population of Central Coast and Southern California Mountain Lion Populations.

Population	Effective Population Size (N_e)	Estimated Total (Adult) Population (N)[1]
Central Coast North (CC-N)	16.6	33-66
Central Coast Central (CC-C)	56.6	113-226
Central Coast South (CC-S)	2.7[2]	5-10
Santa Ana Mountains (SAM)	15.6[3]	31-62
San Gabriel/ San Bernardino Mountains (SGSB)	5	10-20
Eastern Peninsular Range (EPR)	31.6	63-126
Total		255-510

[1]Calculations are based on the estimated ratio of effective to total adult population size (N_e/N) of Florida panthers being 0.25 to 0.5 (Ballou et al. 1989). This ratio was used in the USFWS Florida Panther Recovery Plan (USFWS 2008). Petitioners recognize that these derived population estimates, while informative, are not definitive and will likely be superseded by new population estimates being developed by CDFW.
[2]Benson et al. (2019) calculated an N_e of 4 for the Santa Monica Mountains population within the CC-S. Applying the Ballou et al. (1989) factors would lead to an estimate of 8-16 mountain lions in this area, which is roughly consistent with current estimates of this well-monitored population.
[3]Several studies provide N_e calculation for the SAM population. Ernest et al. (2014) calculated an N_e of 5.1 and Benson et al. (2019) calculated an N_e of 6. Applying the Ballou et al. (1989) factors to the most recent calculation would lead to an estimate of 12-24 mountain lions in the SAM, which is roughly consistent with current estimates.

Although low effective population sizes standing alone are cause for conservation concern for Southern California and Central Coast mountain lion populations, there are other human-caused factors that further limit their long-term persistence. Habitat loss and fragmentation due to roads and development have led to extreme levels of isolation and high mortality rates. With low genetic diversity and high risk of inbreeding depression due to genetic isolation, vehicle strikes on roads, increased conflicts with humans that lead to depredation kills, high levels of intraspecific strife likely due to limited space and lack of connectivity, rodenticide and other environmental toxicant poisoning, and impacts of more frequent human-caused wildfires and climate change, the small isolated mountain lion populations of Southern California and the Central Coast will likely not persist without the restoration and enhancement of functional connectivity between populations and large blocks of heterogeneous habitats**.**

Loss of mountain lions in Southern California and the Central Coast would be devastating not just for the mountain lions themselves but also the many species that directly and indirectly rely on them. These top predators are important ecosystem engineers that facilitate healthy ecosystems and allow biodiversity to thrive (Ripple and Beschta 2006; Ripple and Beschta 2008;

Ripple et al. 2014; Ruth and Elbroch 2014; Barry et al. 2019; Elbroch and Quigley 2019). As keystone species mountain lions help support plant recruitment in riparian areas, stabilize stream banks, and sustain healthy habitats for a myriad of aquatic and terrestrial species, including plants, invertebrates, fish, amphibians, reptiles, birds, and mammals (Ripple and Beschta 2006; Ripple and Beschta 2008; Ripple et al. 2014). Their kills are also an important source of food for multiple terrestrial and avian scavengers (Ruth and Elbroch 2014; Barry et al. 2019; Elbroch and Quigley 2019).

Existing laws and regulations have proven to be inadequate to protect Southern California and Central Coast mountain lions. Although the California Wildlife Protection Act of 1990 (Proposition 117) prohibits hunting of mountain lions and has funded the acquisition of important habitat for preservation, the Act alone does not ensure that core habitats and connectivity are protected from development, highways, or other threats. Moreover, numerous mountain lions are killed each year pursuant to depredation authorizations issued under this regime, and there is no limit to the number of depredation permits a property owner can request or any limit to the number of depredation permits which can be issued for any population. And while CDFW has proactively issued a bulletin detailing a new depredation policy for mountain lions in the CC-S and SAM that requires property owners to first implement non-lethal measures prior to being issued a kill permit, this policy does not apply to other vulnerable populations.

Other environmental laws also are insufficient. State and local agencies continue to interpret the California Environmental Quality Act (CEQA) as allowing for the construction of highways and other development in mountain lion habitat and essential corridor areas without adequate mitigation despite severe impacts of such projects on mountain lions. Agencies likewise have generally interpreted CEQA and the federal National Environmental Policy Act as not requiring implementation of connectivity measures when projects fragment or destroy mountain lion habitat. And perhaps most importantly, Caltrans lacks a clear affirmative mandate to design, build, or improve crossings for mountain lions on existing highways, despite the undisputed role of transportation infrastructure in preventing connectivity and gene flow.

Future human population growth and associated development will further diminish and fragment remaining mountain lion habitat, driving Southern California and Central Coast mountain lions closer to extinction and undermining any chance of recovery. Should state and local agencies continue to build and expand roads and highways and permit construction in wildlife habitat and corridors without ensuring adequate habitat connectivity, the genetic health of mountain lion populations will continue to decline while the number of mountain lions killed by vehicle strikes and other human activity will increase.

Ultimately, without a reversal of these trends, mountain lions will disappear from Southern and Central Coastal California in the coming decades, representing a loss of the species from a significant portion of its range in the state. Nevertheless, most of the threats facing mountain lions can be halted or sufficiently reduced if CDFW is provided with adequate resources and all relevant state and local agencies sufficiently prioritize mountain lion conservation in their decision-making. Legal protection of mountain lions under CESA, along with the attention and resources that such listing will generate, can help ensure the long-term survival of this iconic and ecologically significant species in Southern and Central Coastal California.

The Southern California/Central Coast Evolutionarily Significant Unit (ESU) of Mountain Lions Warrants Listing as Threatened under the California Endangered Species Act (CESA)

1 Introduction

This petition summarizes available scientific information regarding the natural history of mountain lions, their distribution and abundance in California, population trends and threats, describes the proposed ESU, and discusses the limitations of existing management measures in protecting the species. As demonstrated below, mountain lions in Southern California and along the Central Coast meet the criteria for protection as a threatened species under the California Endangered Species Act (CESA), and would benefit greatly from such protection.

2 Life History

2.1 Species Description

Adult female mountain lion (left) and kittens (right). Photos: NPS.

The mountain lion (*Puma concolor*) is also commonly called a puma (from the Inca language Quechua) or cougar (corrupted from cuguacuarana from the indigenous Guarani people in Paraguay, Argentina, Bolivia, and Brazil). Adults are large, slender cats with short, muscular limbs and a long tail that is about one third of the animal's total length. Their hind limbs are longer than their fore limbs, which makes them highly adapted for jumping through rugged terrain or pouncing on their prey. They have tawny pelage that can be lighter/whitish on their belly and the undersides of their legs and they have areas of white around the muzzle, throat and chest. They have black fur on the backs of their rounded ears, the tip of their tail, and outlining their muzzle. Their eyes are a grayish brown to golden color, and the nose is pink with a black outline.

Adult body size and weight can vary depending on the geographic range (Iriarte et al. 1990). Mountain lions are smaller and weigh less near the equator and are larger and heavier towards the poles, which likely reflects the size of available prey and the presence of sympatric carnivores (Iriarte et al. 1990). Males are typically larger than females. Males generally weigh 55-65kg with a length of 2.2-2.3m from the nose to the tip of the tail, and females generally weigh 35-45kg with a length of 2.0-2.1m (Currier 1983).

Mountain lion kittens are born weighing approximately 400g, and their eyes and ear canals remain closed for one to two weeks after birth (Currier 1983). They have light coats with dark spots and a white muzzle, chest, and belly. Like the adults, they have black fur on the backs of their rounded ears, the tip of their tail, and outlining their muzzle. Their eyes are initially blue, change to mostly brown within four months, and then change to a golden color at around nine months (Currier 1983). The dark spots on their coat start to fade at 12-14 weeks of age, presumably when a kitten starts to accompany its mother on hunts, but the spots are still distinguishable until the animal is about one year old (Currier 1983). Adult weight is typically reached between the second and fourth year.

2.2 Taxonomy and Population Genetics

The mountain lion is in the order Carnivora and is a member of the cat family Felidae. Unlike the large, roaring cats of the subfamily Pantherinae (*e.g.*, lions, tigers, and leopards), mountain lions are categorized with small, purring cats in the subfamily Felinae (*e.g.*, bobcats, lynxes, ocelots, cheetahs, and jaguarundi). Their scientific name is *Puma concolor*, formerly called *Felis concolor*. Based on molecular and morphological features, it is thought that mountain lions share a common ancestor with cheetahs (*Acinonyx jubatus*) and jaguarundi (*Puma yaguaroundi*).

Mountain lion fossil records in North America date back 300,000 years (Pierce and Bleich 2003); however, they were likely extirpated during a massive extinction event at the end of the Pleistocene, which eliminated about 80% of large vertebrates in North America (Culver et al. 2000; Caragiulo et al. 2013). Genetic studies suggest that after this extinction event, a small number of Central and South American mountain lions migrated north and repopulated North America (Culver et al. 2000; Caragiulo et al. 2013). As a result, existing North American mountain lions exhibit founder effects and have less genetic diversity compared to mountain lions in Central and South America (Culver et al. 2000; Caragiulo et al. 2013).

There is some debate regarding the number of subspecies of mountain lions. Two subspecies are "tentatively" recognized by the International Union for Conservation of Nature (IUCN) Species Survival Commission (SSC) Cat Specialist Group: *Puma concolor concolor* (Linnaeus, 1771) in South America and *Puma concolor couguar* (Kerr, 1792) in North and Central America and possibly northern South America west of the Andes Mountains (Kitchener et al. 2017). However, there are various studies that suggest the divergence of multiple subspecies of mountain lions. About 30 subspecies of mountain lions throughout the Americas have been referenced in the literature, with about 15 subspecies in North America (Young and Goldman 1946; Currier 1983; Pierce and Bleich 2003).

Based on more recent genetic analyses of mitochondrial DNA (mtDNA) from mountain lions throughout the Americas, Caragiulo et al. (2013) found that the mountain lions they sampled could be separated into three broad groupings: North America, Central America, and South America, with North American mountain lions having the least variation in mtDNA compared to populations in Central and South America. Although that study genotyped 601 specimens, the distribution of sampling within the broad geographic range was limited compared

to a study conducted by Culver et al. (2000), which analyzed mtDNA from 315 mountain lions sampled from more locations throughout the species' geographic distribution. Culver et al. (2000) found six phylogeographic groupings or subspecies throughout the Americas.

Despite this ongoing debate, the United States Fish and Wildlife Services (USFWS) has long recognized mountain lion subspecies under the federal Endangered Species Act (ESA). Two of these subspecies have been protected under the ESA due to low population sizes: the eastern cougar (*Puma concolor couguar*), which was listed as endangered and is now thought to be extinct, with the last recorded occurrence in 1938 (USFWS 2018), and the endangered Florida panther (*Puma concolor coryi*), which is an isolated population that is now restricted primarily to the cypress swamps of southern Florida. In addition, the California mountain lion (*Puma concolor californica*) was recognized by USFWS in response to a 1994 petition by the Mountain Lion Foundation to list the population of California mountain lions in the Santa Ana Mountains as endangered, as those populations that occur within most of California, southern Oregon, western Nevada, and northern Baja California, Mexico (USFWS 1994). Additionally, the California Department of Fish and Wildlife (CDFW) recognizes the Yuma Puma (*Puma concolor browni*) as a (sub)species of special concern that occurs in the desert plains and low mountains along the Colorado River in southeastern California, southwestern Arizona, northeastern Baja California, Mexico, and northwestern Sonora, Mexico (CDFW 1990).

In California, researchers have recently identified 10 genetically distinct mountain lion populations in California and Nevada, nine of which have core areas in California (Figure 1) (Gustafson et al. 2018). In the study, 992 mountain lions from throughout California and Nevada were genotyped using 42 microsatellite loci to identify regional populations and evaluate functional connectedness between the populations (Gustafson et al. 2018). The divergence of these populations is likely the result of habitat fragmentation caused by roads and development (Ernest et al. 2003; Ernest et al. 2014; Riley et al. 2014; Vickers et al. 2015; Benson et al. 2016a; Gustafson et al. 2017; Gustafson et al. 2018; Benson et al. 2019). According to Gustafson et al. (2018), mountain lions in the North Coast and inland populations (Nevada, Eastern Sierra Nevada, Western Sierra Nevada) appear to be better-connected than those in the south and along the central coast, with relatively larger effective population sizes and higher levels of genetic diversity. The authors suggest that these populations may comprise an evolutionarily significant unit (ESU). Considering the genetic source-sink dynamics among the remaining populations (Gustafson et al. 2018), petitioners demonstrate that the populations in Southern California and along the Central Coast collectively comprise an ESU (referred to as the "Southern California/Central Coast ESU"). See *Section 3.0 Southern California and Central Coast Mountain Lions Comprise and Evolutionarily Significant Unit* for more discussion.

The Southern California/Central Coast ESU is comprised of six genetically distinct mountain lion populations: Central Coast North (CC-N, which includes mountain lions in the Santa Cruz Mountains), Central Coast Central (CC-C), Central Coast South (CC-S, which includes mountain lions in the Santa Monica Mountains), San Gabriel/San Bernardino Mountains (SGSB), Santa Ana Mountains (SAM), and Eastern Peninsular Range (EPR) (Figure 1) (Gustafson et al. 2018). Most of these populations appear to be struggling with low genetic diversity and effective population sizes, which puts them at increased risk of extinction (Ernest et al. 2014; Riley et al. 2014; Vickers et al. 2015; Benson et al. 2016a; Gustafson et al. 2018;

Benson et al. 2019). The populations struggling the most include the SAM, CC-S, SGSB, and CC-N populations. Although the CC-C and EPR have slightly higher levels of genetic diversity and effective population sizes, high rates of development in both areas could lead to a similar fate of isolation, genetic drift, low effective population size, and increased risk of extinction in the foreseeable future.

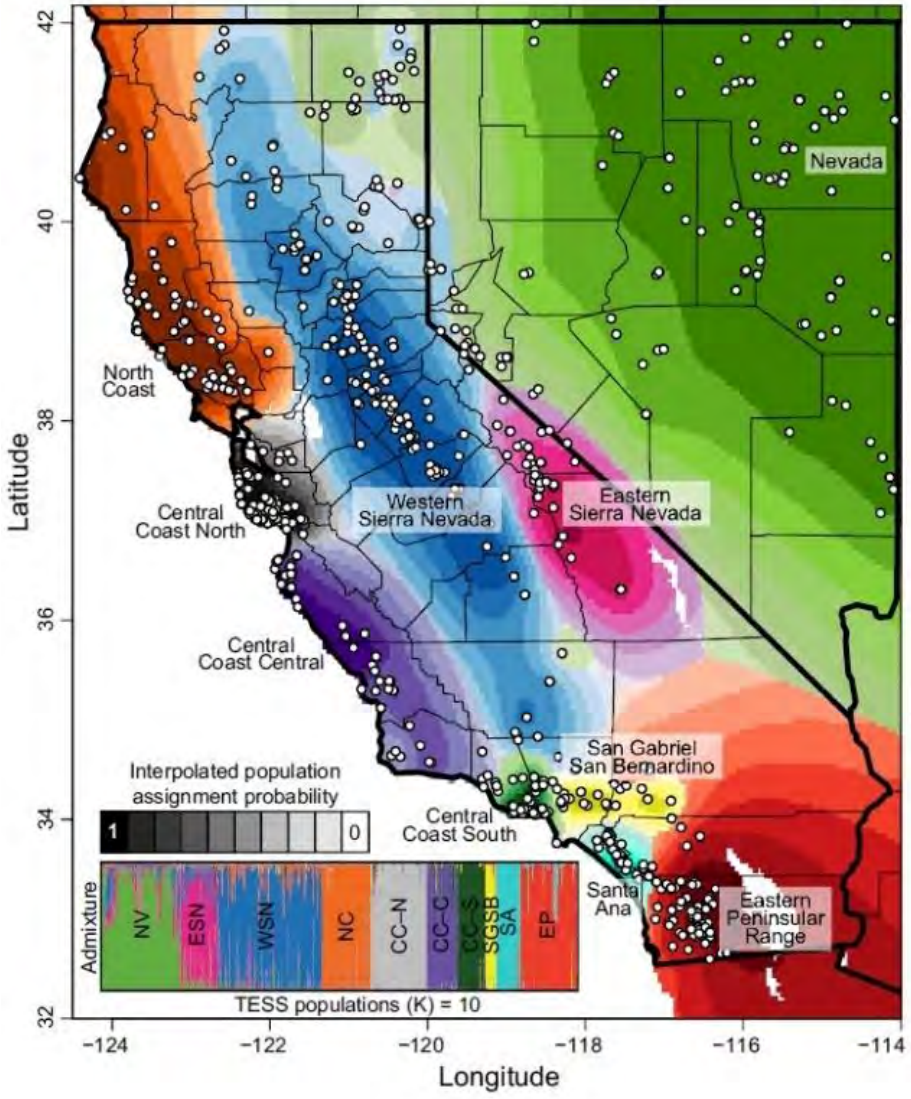

Figure 1. Map of genetically distinct mountain lion populations in California. The Central Coast North (CC-N), Central Coast Central (CC-C), Central Coast South (CC-S), San Gabriel/San Bernardino (SGSB), Santa Ana Mountains (SAM), and Eastern Peninsular Range (EPR) mountain lion populations should be considered an evolutionarily significant unit (ESU). Each color represents a genetically distinct mountain lion population. White dots are individual animals sampled. Source: Gustafson et al. (2018).

Although discrete populations have been identified in Southern California mountain ranges, other mountain lions have been regularly observed outside of the CC-S, SAM, SGSB, and EPR core areas, including transient and resident mountain lions in the Mojave and Colorado deserts and along the Lower Colorado River (*i.e.*, Yuma mountain lion [*Puma concolor browni*], a recognized subspecies of special concern). These populations presumably occur in low

densities due to limited resources, such as lower prey abundance/vulnerability or less suitable habitat. In fact, Kucera (1998) states that habitat within the Yuma mountain lion range is generally considered to be of low or no suitability for mountain lions. Relatively low density populations are inferred by the larger ranges of mountain lions in desert environments; four individual Yuma mountain lions had home ranges of 389km^2 to 1621km^2, which is much larger than other California mountain lion home ranges (Grigione et al. 2002; Riley et al. 2014; Zeller et al. 2017; see *Section 2.5 Habitat Requirements* for more details) but similar to those estimated for other desert mountain lions (Kucera 1998). This petition considers these low-density transients and resident lions as included within the Southern California/Central Coast ESU.

2.2.1 Effective Population Size and Extinction Risk

It has been established that genetic factors play a critical role in extinction risk. Inbreeding depression, loss of genetic diversity, and accumulation of deleterious mutations can lead to elevated extinction risk due to reduced reproductive fitness and evolutionary potential (*i.e.*, the ability to adapt to change) (Spielman et al. 2004; Frankham 2005; Traill et al. 2010). Effective population size (N_e) is a key metric used to assess a population's genetic viability and its chances of long-term persistence. Effective population size is an estimate of the size of an idealized population that would lose heterozygosity (*i.e.*, genetic diversity) at the same rate as the observed population; it indicates a population's rates of inbreeding and genetic drift (changes in allele frequencies over generations based purely on chance). A lower effective population size indicates a higher risk of inbreeding depression. Factors that affect effective population size include census population size (*i.e.*, the total number of individuals within a population), breeding sex ratio, variance in reproductive success, and population density. Several characteristics of these mountain lion populations, including small census population size, low density, female-biased sex ratios, and skewed male reproductive success, reduce effective population size, which suggests that these populations have an increased risk of inbreeding depression and extinction (Ernest et al. 2014; Riley et al. 2014; Vickers et al. 2015; Benson et al. 2016a; Gustafson et al. 2018; Benson et al. 2019).

The minimum effective population size for a population to persist has been debated (*e.g.*, Jamieson and Allendorf 2012; Frankham et al. 2014). Although minimum viable effective population size has been found to vary depending on the species (Frankham 1995), general conservation management practice over the past few decades has followed a 50/500 rule, which purports that an effective population size of 50 is sufficient to prevent inbreeding depression in the short term (over the duration of five generations) and an effective population size of 500 is sufficient to retain evolutionary potential in perpetuity (Frankham et al. 2014). In a 2012 review, Jamieson and Allendorf (2012) concluded that the 50/500 rule is a useful guiding principle in conservation management when genetic concerns are likely to affect the short- and long-term viability of populations. However, Frankham et al. (2014) later revised the 50/500 rule and recommended an effective population size of 100 to limit the loss of total fitness to <10% in the short-term and an effective population size of 1,000 to retain evolutionary potential for fitness in perpetuity, while recognizing that fragmented populations should be evaluated on a case-by-case basis.

Whether the 50/500 or 100/1,000 rule is considered, it is clear that Central Coast and Southern California mountain lion populations are genetically imperiled and face extinction in both the short- and long-term. Five of the six populations have effective population sizes well below 50 (from lowest to highest, according to Gustafson et al. 2018: CC-S, SGSB, SAM, CC-N, EPR), and the remaining population (CC-C) is just barely above that threshold at $N_e = 56.6$ (Table 1) (Ernest et al. 2014; Riley et al. 2014; Benson et al. 2016a; Gustafson et al. 2018; Benson et al. 2019). Although the ratio of effective to total adult population size (N_e/N) varies by species, the effective population size is often much lower than the total adult population size (Frankham 1995). Several studies indicate that the N_e/N in wild vertebrate populations ranges from 0.2 to 0.5 (Ballou et al. 1989; Mace and Lande 1991; Spong et al. 2000; Laundré and Clark 2003). Ballou et al. (1989) estimated the N_e/N to be 0.25-0.5 in their population viability assessment of the Florida Panther, which aligns with other studies on big cats (Frankham 1995; Spong et al. 2000). This range was used in the USFWS's Florida Panther Recovery Plan (USFWS 2008), and, if applied to the Central Coast and Southern California mountain lion populations, the total number of mountain lions in the areas combined would be 255 to 510 individuals (Table 1). This is well below the recommended minimum viable population size of at least 5,000 adult individuals for the long-term persistence of a population (Frankham 1995; Reed et al. 2003; Traill et al. 2010).

Table 1. Effective population size and estimated total adult population of Central Coast and Southern California Mountain Lion Populations from Gustafson et al. (2018).

Population	Effective Population Size (N_e)	Estimated Total (Adult) Population (N)[1]
Central Coast North (CC-N)	16.6	33-66
Central Coast Central (CC-C)	56.6	113-226
Central Coast South (CC-S)	2.7[2]	5-10
Santa Ana Mountains (SAM)	15.6[3]	31-62
San Gabriel/ San Bernardino Mountains (SGSB)	5	10-20
Eastern Peninsular Range (EPR)	31.6	63-126
Total		255-510

[1]Calculations are based on the estimated ratio of effective to total adult population size (N_e/N) of Florida panthers being 0.25 to 0.5 (Ballou et al. 1989). This ratio was used in the USFWS Florida Panther Recovery Plan (USFWS 2008). Petitioners recognize that these derived population estimates, while informative, are not definitive and will likely be superseded by new population estimates being developed by CDFW.

[2]Benson et al. (2019) calculate an N_e of 4 for the Santa Monica Mountains population within the CC-S. Applying the Ballou et al. (1989) factors would lead to an estimate of 8-16 mountain lions in this area, which is roughly consistent with current estimates of this well-monitored population.

[3]Several studies provide N_e calculation for the SAM population. Ernest et al. (2014) calculated an N_e of 5.1 and Benson et al. (2019) calculated an N_e of 6. Applying the Ballou et al. (1989) factors to the most recent calculation would lead to an estimate of 12-24 mountain lions in the SAM, which is roughly consistent with current estimates

Habitat loss and fragmentation due to roads and development have led to extreme levels of isolation in these populations, which have lowered their effective population sizes and, ultimately, their ability to survive and reproduce with a diverse gene pool (Ernest et al. 2014; Riley et al. 2014; Benson et al. 2016a; Gustafson et al. 2018; Benson et al. 2019). However, re-establishing gene flow among isolated subpopulations of a species can increase effective population size and reduce extinction risk (Frankham et al. 2014). Thus, the implementation of wildlife crossing infrastructure at existing barriers along with the preservation of intact, heterogeneous habitats would facilitate connectivity among Central Coast and Southern California mountain lion populations and significantly improve their chances of long-term survival.

2.2.2 Central Coast North (CC-N) Mountain Lion Population

In a statewide study, Gustafson et al. (2018) found that the CC-N population clustered genetically with the CC-C and CC-S populations. The population exhibited evidence of a previous genetic bottleneck and was found to have low genetic diversity and a low effective population size (N_e = 16.6). There is some evidence, though weak, that suggests the CC-N population is a source population, with limited gene flow with the other Central Coast populations and the Western and Eastern Sierra Nevada populations (Gustafson et al. 2018). CDFW has identified that the Santa Cruz Mountains population, which occurs within the CC-N area, is struggling due to fragmentation from roads and development as well as lack of protected habitat (Dellinger 2019). The low genetic diversity and effective population size threaten both the short- and long-term survival of the CC-N population.

2.2.3 Central Coast Central (CC-C) Mountain Lion Population

The CC-C mountain lion population has been found to exhibit a previous genetic bottleneck (Gustafson et al. 2018). It has intermediate levels of genetic diversity and the highest effective population size (N_e = 56.6) among the Central Coast and Southern California populations (Gustafson et al. 2018). Although this effective population size exceeds the older standard of 50 to prevent in-breeding depression in the short-term, it falls well below the recommended newer standard of 100 and is insufficient for the long-term persistence of the population. This population was found to be clustered genetically with the CC-N and CC-S populations and identified as a source population with limited gene flow with other Central Coast populations, the Western and Eastern Sierra Nevada populations, and the SGSB population (Gustafson et al. 2018). Although the CC-C population appears to be the healthiest population in the Central Coast and Southern California, the lack of sufficient protected lands and high rates of development and habitat fragmentation in the area threaten the persistence of this population (Dellinger 2019).

2.2.4 Central Coast South (CC-S) Mountain Lion Population

The CC-S mountain lion population has been found to exhibit a prior genetic bottleneck, with low genetic diversity and an extremely low effective population size (N_e = 2.7 to 4) (Riley et al. 2014; Benson et al. 2016a; Gustafson et al. 2018; Benson et al. 2019). This population was

found to be clustered genetically with the CC-N and CC-C populations and identified as a genetic sink population, with limited gene flow from mountain lions along the Central Coast and in the Sierra Nevada (Gustafson et al. 2018).

A recent population viability analysis focused on the Santa Monica Mountains population, a subpopulation within the CC-S that has been severely isolated due to roads and development, found that if the population remains isolated with little or no immigration (similar to what is currently being observed in the area), the population could experience high levels of genetic erosion, with 40-57% loss of predicted heterozygosity within 50 years (Benson et al. 2016a). When considering just demographic processes with little or no immigration and no inbreeding depression, the population was predicted to have a 15-22% chance of extinction within 50 years (Benson et al. 2016a; Benson et al. 2019). However, if inbreeding depression occurs, which is a strong possibility given the predicted substantial loss of genetic diversity and the documentation of father-daughter, grandfather-granddaughter, and grandmother-grandson inbreeding within the population (*e.g.*, Riley et al. 2014)[3], population growth will likely decline and chances of extinction within 50 years is predicted to be 99.7%, with a median time to extinction of 15.1 years (Benson et al. 2016a; Benson et al. 2019).

2.2.5 Santa Ana Mountains (SAM) Mountain Lion Population

The SAM mountain lion population has been found to have the lowest genetic diversity of all populations in California, with levels nearly as low as the endangered Florida panther (Ernest et al. 2014; Gustafson et al. 2017; Gustafson et al. 2018; Benson et al. 2019). This population is also estimated to have a low effective population size (N_e = 5.1 to 15.6) and high levels of relatedness and inbreeding (Ernest et al. 2014; Gustafson et al. 2018; Benson et al. 2019). The SAM population was found to be a genetic sink population, with limited gene flow with the EPR population (Gustafson et al. 2018). In a 16-year study (2001-2016) seven migrants (out of 146 sampled animals), were detected via genetics and GPS collar tracking to have crossed the I-15 between the EPR and SAM (three males from the EPR to SAM, four males from the SAM to the EPR); only one migrant is known to have reproduced (Gustafson et al. 2017). Low genetic diversity and effective population size in the SAM are indicative of a genetic bottleneck that is estimated to have occurred 40-80 years ago, around the time when urban development and multi-lane highway construction boomed in Southern California (Ernest et al. 2014; Gustafson et al. 2018). This population was also found to be largely disconnected from all the other California populations, along with the EPR population.

A recent population viability analysis found that if the population remains isolated with little or no immigration (similar to what is currently being observed in the area), the population could experience further genetic erosion, with 28-49% loss of predicted heterozygosity within 50 years (Benson et al. 2019). When considering just demographic processes with little or no immigration and no inbreeding depression, the population was predicted to have a 16-21% chance of extinction within 50 years. However, to avoid inbreeding depression in wild populations, loss in heterozygosity should be less than 5-10% over 100-200 years (Soule et al. 1986; Benson et al. 2016a), which suggests that inbreeding depression in the SAM population is

[3] Inbreeding has been documented in the SMM population in Riley et al. 2014 and in ongoing studies by the NPS. More information from the NPS is available here: https://www.nps.gov/samo/learn/nature/puma-profiles.htm

a strong possibility. In addition, evidence of potential inbreeding depression has been observed in the population (*e.g.*, kinked tails coupled with low genetic diversity, Figure 2, Ernest et al. 2014). When inbreeding depression was considered in the population viability analysis, population growth will likely decline and chances of extinction within 50 years is predicted to be 100%, with a median time to extinction of 11.7 years (Benson et al. 2019).

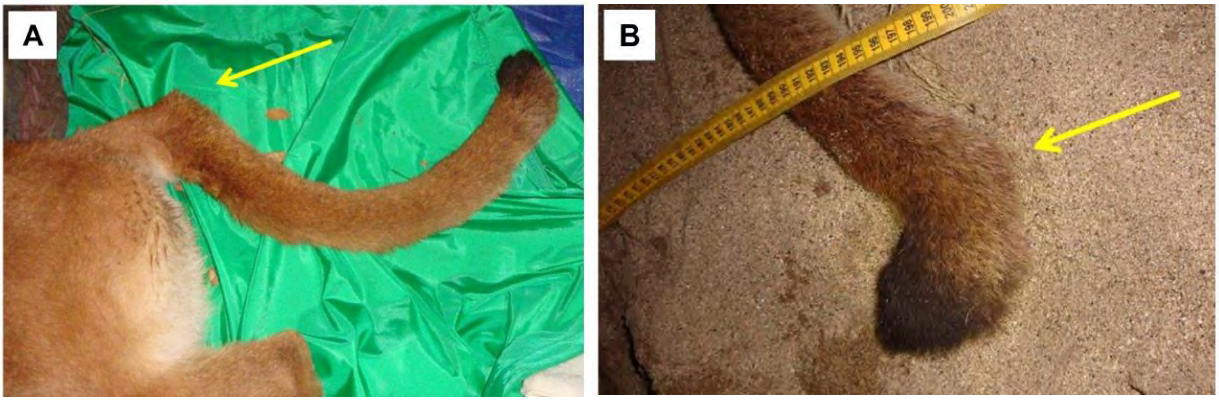

Figure 2. Two SAM mountain lions with a kink at the base of the tail (A) and near the tip of the tail (B). These individuals had among the lowest genetic diversity measured in the study. Source: Ernest et al. 2014.

2.2.6 San Gabriel/San Bernardino Mountains (SGSB) Mountain Lion Population

According to Gustafson et al. (2018), the SGSB mountain lion population exhibits extremely low genetic diversity and effective population size ($N_e = 5$), though the sample size from SGSB was low. They were also found to be a sink population, with limited gene flow with populations in the Western Sierra Nevada, CC-C, and the EPR (Gustafson et al. 2018). Although genetic studies on this population are limited, patterns of isolation, loss of genetic diversity, and low effective population size are similar to those of the SAM and CC-S populations and likely indicate a high risk of extinction. Not only is the population's long-term survival at stake, but the geographic location of the SGSB population is paramount. Despite only limited gene flow between the SGSB population and the Western Sierra Nevada, CC-C, and EPR, this population represents a critical linkage between mountain lion populations in the northern, central coast, and southern mountain ranges of California (Gustafson et al. 2018). Restoration and enhancement of connectivity is key for the continued survival of the SGSB population as well as the Central Coast and Southern California mountain lion populations.

2.2.7 Eastern Peninsular Range (EPR) Mountain Lion Population

Gustafson et al. (2018) found that the EPR population exhibits a prior genetic bottleneck. Although the population was found to have a higher effective population size than the other Southern California mountain lion populations ($N_e = 31.6$), this is still well below the older standard of 50 to prevent in-breeding depression in the short-term and is insufficient for the long-term persistence of the population. In addition, the EPR population was found to be largely disconnected from all the other California populations, with limited gene flow and low connectivity with the SAM and SGSB populations (Gustafson et al. 2018). With continued development in San Diego, Riverside, and Imperial Counties, the EPR population could have a

similar fate of isolation, genetic drift and inbreeding, and risk of extinction as the other Central Coast and Southern California populations.

As mentioned previously, there are records for mountain lions outside of the core mountain ranges in Southern California, which are likely transients or residents of smaller populations. For example, the Yuma mountain lion has been recognized by CDFW as a subspecies of special concern, and likely occurs in low density in the desert plains and low mountains of the Colorado River Valley. Genetic studies on the Yuma mountain lion are limited, and no samples were obtained from that area for the study conducted by Gustafson et al. (2018). However, the low densities of transients and smaller populations in areas where roads and development threaten connectivity make them part of the EPR and larger Southern California population, and as such, they are considered a conservation concern and are included in this petition.

2.3 Reproduction and Growth

Dens are often in rocky outcrops (left) or in dense vegetation (right). Photos: NPS.

Mountain lions are polygamous breeders, and mates likely locate each other with auditory and olfactory signals (Currier 1983). They may reproduce at any time of year, though seasonal pulses have been documented and the timing of reproduction may be affected by prey abundance or climate (Pierce and Bleich 2003). In North America, kitten births are most common between April and September (Currier 1983; Beier 1995; Pierce and Bleich 2003).

Pairs generally mate for about 2-5 days (Beier et al. 1995), though there are instances in which pairs have been recorded traveling together for up to 16 days (Seidensticker et al. 1973). During this time they vocalize frequently, travel little, will sometimes share a kill, and copulate up to 70 times per day (Seidensticker et al. 1973; Beier et al. 1995; Pierce and Bleich 2003). Female estrous cycles last an estimated 4-12 days, and it is hypothesized that numerous acts of copulation stimulate ovulation and improve chances of successful fertilization (Pierce and Bleich 2003, Kitchener 1991). If the litter is born dead or removed within 24 hours of birth, females will go into estrous within a few weeks (Currier 1983). In addition, competing males have been

known to commit infanticide[4], presumably to trigger estrous in females, though scientists are still investigating what drives this behavior.

Gestation lasts 82-96 days (Young and Goldman 1946; Currier 1983). Litter size ranges from 1-6, though 2-4 kittens per litter are typical (Pierce and Bleich 2003; Beier et al 2010; Riley et al. 2014). Females average larger litters during their first year of reproduction and tend towards smaller litters when they are older (Pierce and Bleich 2003). The sex ratio of litters has generally been found to be equal (Pierce and Bleich 2003). Females keep their kittens in dens located in rocky terrain or in dense vegetation that provide cover (Young and Goldman 1946), and they may move their young to several different dens until the young are weaned at about 2-3 months old (Pierce and Bleich 2003). Denning mountain lions have been found to avoid roads and stay at a distance from human disturbance four times greater (~600m) than non-reproductive mountain lions (~150m) (Wilmers et al. 2013).

Females care for their young for 1-2 years, at which point the mother comes into estrous and either abandons the cubs or acts aggressively towards them to prevent them from following her, as older males will kill cubs (Young and Goldman 1946; Seidensticker et al. 1973; Currier 1983; Beier 1995; Pierce and Bleich 2003). Newly independent young have been found to stay in the area where the mother leaves them for 2-3 weeks, and then disperse away from the direction their mother left (Beier 1995). Typically 50% of females stay in their natal range and 50% disperse while all males disperse, and siblings sometimes travel for a short time together (Pierce and Bleich 2003; Logan and Sweanor 2010). Subadult mountain lions may disperse up to 500km from their natal home ranges as they explore and establish their own territories (Pierce and Bleich 2003).

Mountain lions reach sexual maturity at 2-4 years of age. Although they are rarely known to mate until they have an established home range, transient males may occasionally breed with resident females (Hornocker 1970; Seidensticker et al. 1973; Currier 1983).

2.4 Diet and Foraging Ecology

Mountain lion cub feasting on a deer kill in the Santa Monica Mountains. Photo: NPS.

[4] Infanticide has been documented in the Santa Monica Mountains mountain lion population. More information from the NPS is available here: https://www.nps.gov/samo/learn/nature/puma-profiles.htm

Large ungulates, especially deer, are the preferred prey of mountain lions, making up about 70% of their diet (Currier 1983; Iriarte et al. 1990). Hornocker (1970) estimated that the average adult mountain lion consumes 860-1,300kg of large prey annually. However, mountain lions are opportunistic predators, and they have been documented eating a wide variety of other large and smaller prey, including moose, elk, wild horses, burros, pronghorn, bighorn sheep, mountain goats, wild hogs, coyotes, bobcats, porcupines, badgers, rabbits, raccoons, rodents, turkeys, and livestock (Currier 1983; Iriarte et al. 1990; Garcelon unpublished data).

Their diet can vary by prey availability, prey vulnerability, the presence of sympatric carnivores, the season, and the age and sex of the mountain lion (Currier 1983; Iriarte et al. 1990; Knopff et al. 2010; Allen et al. 2014a). For example, deer have been found to make up >90% of the diet in mountain lions in the Santa Monica Mountains and in Northern California (Allen et al. 2014a; Riley et al. 2014), while in Florida wild hogs were found to be the most common prey (Maehr et al. 1990), and in northwestern Sonora, Mexico bighorn sheep were found to be the primary prey (Rosas-Rosas et al. 2003). These observed patterns were likely due to the availability of different prey in different geographic regions. A study conducted in Alberta, Canada, Knopff et al. (2010) found that while adult females were more likely to kill small ungulates (*e.g.*, deer), adult males were more likely to kill larger ungulates (*e.g.*, elk), and subadults relied on both small ungulates and nonungulate prey (*e.g.*, beavers, snow hares). A similar pattern was found in a mountain lion population in the Greater Yellowstone Ecosystem, in which older, larger individuals hunted larger prey and younger, smaller individuals hunted smaller prey (Elbroch and Quigley 2019). In addition, mountain lions were found to prey upon female ungulates in the spring before and during the birthing period, and they would more often prey upon male ungulates in the fall during the rut, highlighting that prey vulnerability may play a role in mountain lion predation (Knopff et al. 2010).

Mountain lion preying on a coyote in Joshua Tree, California. Photo: Brendan Cummings

Mountain lions roam through expansive home ranges in search of prey, often hunting between dusk and dawn. Although they are generally most active at dusk and dawn, their peak activities have been observed to shift to more nocturnal patterns when they are closer to human

disturbance (Van Dyke et al. 1986). Mountain lions are primarily solitary animals and will repeatedly move and wait as they stalk and ambush their prey (Beier et al. 1995). Once within close proximity, mountain lions will lunge at their prey and kill the animal by crushing the trachea and suffocating it or by breaking its neck at the base of the skull with a bite (Currier 1983; Pierce and Bleich 2003). Instead of eating their kill right away, mountain lions drag their kill to a secluded spot to feed. They cover it with brush and other debris and return to feed at night for up to five days (Currier 1983; Beier et al. 1995). However, the presence or perceived presence of humans has been found to reduce overall feeding time (Smith et al. 2015; Smith et al. 2017).

Deer kill rates vary depending on the sex of the mountain lion, whether or not the female has cubs, and surrounding human land use. Male kill rates have been found to range from 35 to 47 ungulates per year, regardless of housing density (Anderson , Jr . and Lindzey 2003; Cooley et al. 2008; Knopff et al. 2010; Smith et al. 2015). However, kill rates for females differ depending on human disturbance. In lower density housing areas, kill rates of solitary females and females with kittens have been found to be 52-60 and 57-68 ungulates per year, respectively, while females in high density housing areas were found to have a kill rate of 81 ungulates per year (Anderson , Jr . and Lindzey 2003; Cooley et al. 2008; Knopff et al. 2010; Smith et al. 2015). This pattern could be driven by reduced time spent at kill sites in more developed areas, indicating that females are not consuming as much of each carcass and therefore need to kill more prey (Smith et al. 2015). This may reflect a trade-off made by females to choose feeding sites closer to human-disturbed areas and expend more energy killing prey in order to reduce potential encounters with males that pose a threat to themselves or their kittens (Benson et al. 2016b). Another factor that may be contributing to higher kill rates in developed areas is that mountain lions expend more energy traveling faster and farther in human-dominated landscapes and therefore require increased caloric intake compared to mountain lions away from developed areas (Wang et al. 2017).

2.5 Habitat Requirements

Mountain lions are primarily solitary (except in certain situations, such as when breeding, when females are rearing cubs, or when dispersing with siblings), territorial cats that occur in low density. They require large areas of relatively undisturbed habitats with adequate connectivity to allow for dispersal and gene flow. They have large home ranges that include heterogenous habitats. In the United States these often consist of pine forests, riparian and oak woodlands, streams, chaparral, and grasslands, though they are also known to occur in desert habitats (*e.g.*, Figure 3).

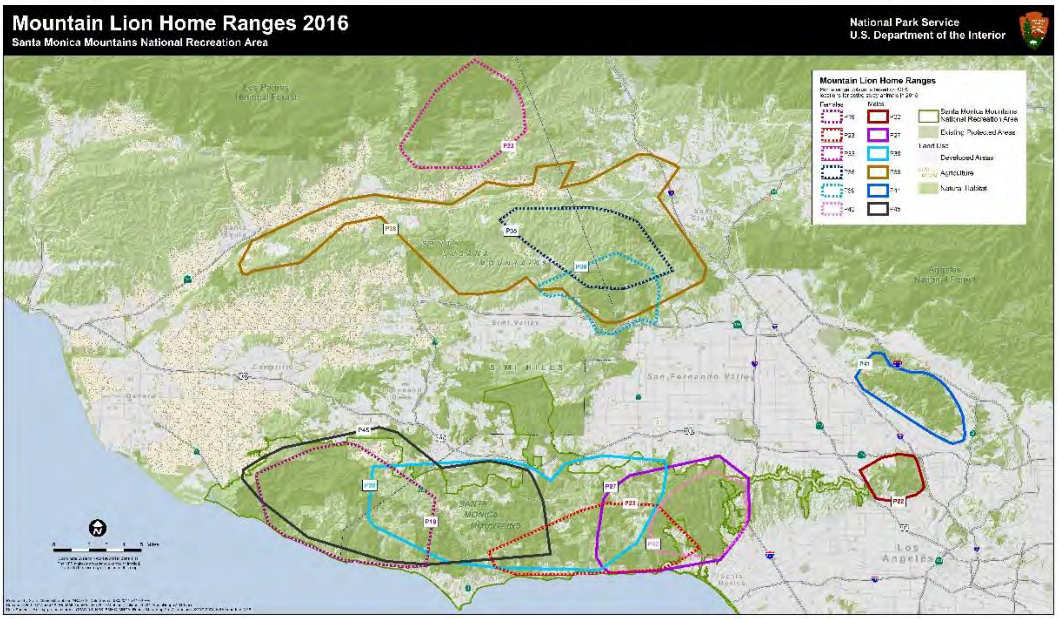

Figure 3. Home ranges of mountain lions being actively studied in 2016 by NPS in and near the Santa Monica Mountains. Source: NPS.

Mountain lions have been found to utilize different habitats within a 24-hour period (Dickson and Beier 2002; Dickson et al. 2005; Dickson and Beier 2006; Kertson et al. 2011; Zeller et al. 2017). Riparian habitats were found to be preferred over grasslands and human-disturbed areas during the day, which likely represents the animals resting in areas with understory vegetation for cover (Dickson and Beier 2002; Dickson et al. 2005). However, nocturnal movement patterns showed that mountain lions utilize a broad range of habitats as they travel through their home ranges and hunt (Dickson et al. 2005). Although riparian vegetation was the highest ranked habitat for nocturnal use, usage of riparian areas was not statistically different from the use of scrub, chaparral, grasslands, or woodlands (Dickson et al. 2005).

Nocturnal patterns of movement and stasis suggest that mountain lions generally avoid areas with human disturbance (*i.e.*, residential developments and two-lane paved roads) and use a variety of habitats to stalk and pursue their prey (Dickson and Beier 2002; Dickson et al. 2005). In addition, Dickson and Beier (2006) found that when mountain lions were traveling or hunting, they preferred canyon bottoms and gentle slopes and used steeper slopes and ridgelines to a lesser extent. And Benson et al. (2016b) found that mountain lions tend to choose feeding sites on steeper slopes in habitats with dense understory vegetation, such as chaparral, scrub, and upland forest. Although mountain lions will use moderately disturbed areas as they travel and hunt (Wilmers et al. 2013; Gray et al. 2016), occupancy is lower in developed areas and they are more likely to use developed areas if they border open spaces (Wang et al. 2015). Thus, mountain lions require a habitat mosaic that provides sufficient room to roam away from human-disturbed areas and connected to expansive, intact, heterogeneous habitats (Beier 1995; Dickson and Beier 2002; Dickson et al. 2005; Kertson et al. 2011; Zeller et al. 2017).

Home range size can vary depending on geographic area, season, sex, reproductive status, and prey density (Currier 1983; Grigione et al. 2002; Riley et al. 2014). Males generally have

much larger home ranges than females, and females with cubs tend to have even smaller home ranges (Beier et al. 1995; Grigione et al. 2002). Male home ranges tend to include partially or entirely overlapping female home ranges, and to a limited extent, they may partially overlap with other male home ranges (Figure 3) (Seidensticker et al. 1973; Currier 1983; Pierce and Bleich 2003). Mountain lions mark their home ranges with scrapings in the ground, often containing urine or feces (Seidensticker et al. 1973). Males make scrapings more often than females (Allen et al. 2014b), and females may only make scrapings when they are in estrous (Seidensticker et al. 1973; Currier 1983; Pierce and Bleich 2003).

Seasonal variation in home range size can differ depending on geographic area. Grigione et al. (2002), found strong influences of seasonality in average mountain lion home ranges in the Sierra Nevada mountains, with much larger home ranges in the summer (541km^2 for females, 723km^2 for males) compared to those in the winter (349km^2 for females, 569km^2 for males). These patterns likely reflect the abundance and distribution of deer – during the winter deer would be concentrated at lower elevations, which allowed mountain lions to reduce their home ranges, while in the summer deer could disperse to higher elevations and the mountain lions would expand their ranges accordingly (Grigione et al. 2002). However, seasonal variation was not as pronounced and had the reverse trend in Coastal California mountain ranges, including in the SAM, where the average area of winter home ranges was slightly larger (100km^2 for females, 350km^2 for males) than summer home ranges (90km^2 for females, 300km^2 for males) (Grigione et al. 2002). These differences were not statistically significant, and this pattern is likely due to the moderate year-round climate in the coastal ranges, where prey abundance and distribution does not exhibit as extreme shifts as those in the Sierra Nevada (Grigione et al. 2002). This generally aligns with Zeller et al. (2017), who found that mountain lion home ranges in the SAM and EPR ranged from 41-497 km^2, with mean home range sizes of 188km^2 for females and 316 km^2 for males. And Riley et al. (2014) found that CC-S mountain lions had home ranges similar in size to the SAM and EPR mountain lions, with female home ranges being 100-200km^2 and male home ranges being 300-500 km^2. According to the Santa Cruz Puma Project, in the Santa Cruz Mountains female home ranges are on average about 100 km^2 and male home ranges are about 230 km^2 (Santa Cruz Puma Project 2015). Although studies are limited regarding the home range size of the CC-C and SGSB mountain lions, given their close proximity and similar seasonality to other Central Coast and Southern California populations, they are likely similar.

2.6 Survivorship and Mortality

According to the National Park Service (NPS), mountain lions can live up to 13 years in the wild. As a top carnivore with no natural predators, conspecifics and humans are the main drivers of mountain lion survivorship and mortality. Although studies regarding kitten (<18 months), subadult (18-30 months), and adult (>30 months) survivorship are limited, some long-term studies of radio-collared mountain lions on the CC-S, SAM, and EPR provide valuable insights for these Central Coast and Southern California populations (Beier and Barrett 1993; Riley et al. 2014; Vickers et al. 2015).

In a study conducted in the CC-S area (which encompasses the Santa Monica Mountains, Simi Hills, and Santa Susana Mountains) that included 42 mountain lions from 2002 to 2012, Riley et al. (2014) found an annual adult survival of ≥ 75%, though Benson et al. (2016a) found

lower subadult survival rates. Although adult survival in the CC-S is similar to previous studies conducted in California and the southwestern US (Beier 1993; Logan and Sweanor 2001), it is higher than what was found in the SAM and EPR populations during the same time period. From following 74 radio-collared mountain lions from 2001 to 2013, Vickers et al. (2015) found an annual survival rate across all age groups of 56.5% and 55.4% in the SAM and EPR, respectively.

In the Santa Monica Mountains: Female mountain lion P-23 hunted down a deer on Mulholland Drive (left). In 2018 she was killed by a vehicle strike on Malibu Canyon Road. An uncollared mountain lion killed by a vehicle strike on Malibu Canyon Road in 2004 (right). Photos: NPS

Vehicle strikes, depredation kills, and intraspecific strife (including male aggression towards conspecifics and infanticide) are the primary causes of mortality in the Central Coast and Southern California populations (Beier 1993; Riley et al. 2014; Vickers et al. 2015). Other known causes of death in California mountain lion populations include rodenticide poisoning, disease, poaching/illegally killing, starvation/abandonment, public safety removal, and human-caused wildfires (Beier 1993; Riley et al. 2014; Vickers et al. 2015). Causes of mortality will be discussed more in depth in *Section 5.0 Abundance and Population Trends* and *Section 6.0 Factors Affecting Ability to Survive and Reproduce*.

3 Southern California and Central Coast Mountain Lions Comprise an Evolutionarily Significant Unit

3.1 CESA Provides for Listing of ESUs

CESA defines an "endangered species" as a species or subspecies of animal or plant that is in serious danger of becoming extinct through either all or "a significant portion" of its range. (Cal. Fish & Game Code § 2062.) A "threatened species" is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts. (Cal. Fish & Game Code § 2067.) CDFW has concluded—and appellate courts have upheld—that the term "range" is construed to refer to the range of a species or subspecies *within* California, not the worldwide range of the species or subspecies. (*California Forestry Assn. v. California Fish & Game Com.* (2007) 156 Cal.App.4th 1535, 1550-551.) This means that a species or subspecies which may not be endangered in other states or countries may still be endangered within California. Courts also have confirmed that the phrase "significant portion" of

a range authorizes CDFW to designate certain populations of a species or subspecies as "evolutionarily significant units" or "ESUs" and list such populations as endangered under CESA. (*Id.* at 1549; *Central Coast Forest Assn. v. Fish & Game Com.* (2018) 18 Cal.App.5th 1191, 1236-37 [*"CCFA II*"].) In other words, ESUs are a population of a species or subspecies "that is considered distinct for purposes of conservation." (*Central Coast Forest Assn. v. Fish & Game Com*. (2012) 211 Cal.App.4th 1433, 1439 fn 5 [depublished] ["*CCFA I*"].)

CDFW has confirmed that the use of ESUs to evaluate the status of species pursuant to CESA is appropriate.[5] In the *Status Review of Fisher*, CDFW designated fishers in northern California and the southern Sierra Nevada as two separate ESUs based upon the reproductive isolation of these fisher populations and the degree of genetic differentiation between them. In designating these ESUs, CDFW highlighted the need to maintain "geographically widespread and genetically diverse" populations of the species.

3.2 Southern California and Central Coast Mountain Lions are Significantly Reproductively Isolated from Other Populations and Form an ESU

Southern California and Central Coast mountain lion populations could be grouped into one or several potential ESUs. However, petitioners believe that for purposes of listing under CESA, treating the CC-N, CC-C, CC-S, SAM, SGSB, and EPR populations as a single Southern California/Central Coast ESU is both supported by the best available science and makes sense from a management perspective. Gustafson et al. (2018) suggest that the North Coast and inland populations (Nevada, Eastern Sierra Nevada, and Western Sierra Nevada) may form an ESU (hereinafter "North Coast/Inland ESU") given that they were found to be genetically diverse and well-connected. Due to extreme isolation and high levels of human-caused mortalities, functional connectivity between Southern California and Central Coast mountain lion populations and the healthier North Coast/Inland ESU has become severely impaired (Gustafson et al. 2018, see further discussion in *Section 2.2 Taxonomy and Population Genetics* and *Section 6.0 Factors Affecting Ability to Survive and Reproduce*). There is a tenuous link made up of small mountain ranges (*i.e*., Tehachapi and Sierra Pelona Mountains) that connect the North Coast/Inland ESU with the proposed Southern California/Central Coast ESU. Thus, although there is some (limited) connectivity between the North Coast/Inland ESU and the proposed ESU, as a practical matter under current management the two ESUs are functionally isolated.

Southern California and Central Coast populations have lower levels of genetic diversity and are relatively disconnected from each other compared to North Coast and inland populations. The Central Coast populations form a genetic cluster while the SAM and EPR populations form a second, less connected genetic cluster (Figure 4) (Gustafson et al. 2018). The SGSB population, though isolated, is most genetically similar to the Western Sierra Nevada, CC-C, and EPR populations, which indicates that it is an important intersection for statewide genetic connectivity (Figure 4) (Gustafson et al. 2018).

Genetic source-sink dynamics are informative in determining gene flow among the populations and how they are connected. Five genetic source populations were identified: the

[5] California Department of Fish and Wildlife, *Status Review of Fisher* (June 10, 2015), available at https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=101470.

Eastern and Western Sierra Nevada populations, CC-N, CC-C, and EPR (Gustafson et al. 2018). The Sierra Nevada populations were the greatest genetic source populations and the CC-N population had only weak evidence of being a source population (Gustafson et al. 2018). The CC-S, SGSB, and SAM were identified as genetic sink populations with limited connectivity to source populations (Figure 4) (Gustafson et al. 2018). Maintaining and reestablishing genetic connectivity with source populations like the CC-C, EPR, and Western Sierra Nevada populations are important for the long-term viability of Southern California and Central Coast populations (Ernest et al. 2014; Riley et al. 2014; Vickers et al. 2015; Benson et al. 2016a; Gray et al. 2016; Gustafson et al. 2017). This underscores the importance of the Tehachapi and Sierra Pelona Mountains as the key remaining linkage, though tenuous, for statewide genetic connectivity.

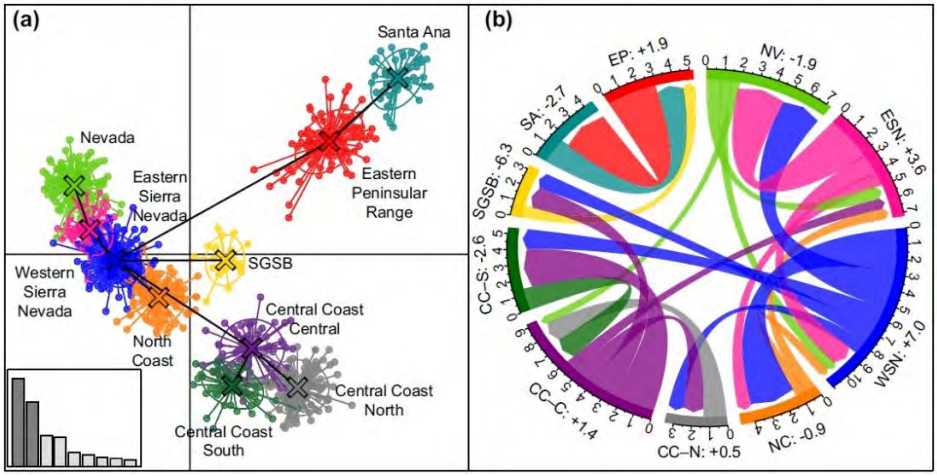

Figure 4. Functional connectedness of California mountain lion populations. Each color represents a genetically distinct population. In (a), the results of the discriminant analysis of principal components shows connectivity among California mountain lions. The x-axis represents latitude with north to the left and south to the right. The y-axis represents longitude, separating the Central Coast populations from Southern California populations. In (b), estimated migration rates between populations are shown. Source-sink dynamics are indicated by positive (source) or negative (sink) net migration rates. Source: Gustafson et al. (2018).

While genetics as currently understood could support several different ESU formulations, petitioners believe a single Southern California/Central Coast ESU is the most pragmatic from a management perspective, as recovery of the individual subpopulations ultimately depends upon maintaining and/or reestablishing connectivity between them. *See CCFA II,* 18 Cal.App.5th 1191, 1237 ("[T]he nature of the ESU designation is such that genetics alone are not determinative: One must look beyond genetics to questions of policy to determine which populations to include in an ESU.") (quotations omitted). Designating Southern California and Central Coast mountain lions as an ESU would help ensure "geographically widespread and genetically diverse" populations of mountain lions in California.

While petitioners believe that listing of a single Southern California/Central Coast ESU as threatened is both a permissible and prudent course of action for the Commission, petitioners also request that as additional data become available over the course of CDFW conducting its status review that the agency also assess other possible ESU formulations for Southern California and Central Coast mountain lions. One such formulation would be to group all three Central Coast populations (CC-N, CC-C and CC-S) into one ESU, with the remaining three

populations placed into a second ESU (SAM, EPR and SGSB). Alternatively, the Central Coast populations could be treated as one ESU, SAM and EPR as a second ESU, and SGSB separately listed as a third ESU. Petitioners believe the genetic data in Gustafson et al. (2018) could support each of these alternative formulations. Lastly, given each of the six populations at issue are themselves already genetically distinguishable and occupy significant portions of the range of mountain lions in California, each could be separately treated as an ESU. Under this formulation, the SAM and CC-S populations would clearly warrant endangered listing, the CC-C and EPR populations would warrant threatened listing, and the CC-N and SGSB populations would warrant at least threatened and likely endangered listing.

3.3 Proposed Boundary of the Southern California/Central Coast ESU

We propose the Southern California/Central Coast ESU to include mountain lions that occur in areas east of the Pacific Ocean, south of the San Francisco Bay Area waters and I-80, west of I-5 to the intersection of I-5 and SR-58 at Bowerbank/Buttonwillow, south of SR-58 to I-15, south of the I-15 from the SR-58 intersection to the California-Nevada border, and, for the purposes of CESA, north of the California-Mexico border (Figure 5). These boundaries are recommended as they include virtually all mountain lions associated with the six populations comprising the ESU and are also unambiguous and readily discernable for purposes of management.[6]

[6] In the event the Commission determines that the proposed ESU should instead be treated as separate Southern California (SAM, EPR, SGSB) and Central Coast (CS-N, CS-C, CS-S) ESUs, we propose the boundary between them to be delimited by I-5 and I-710.

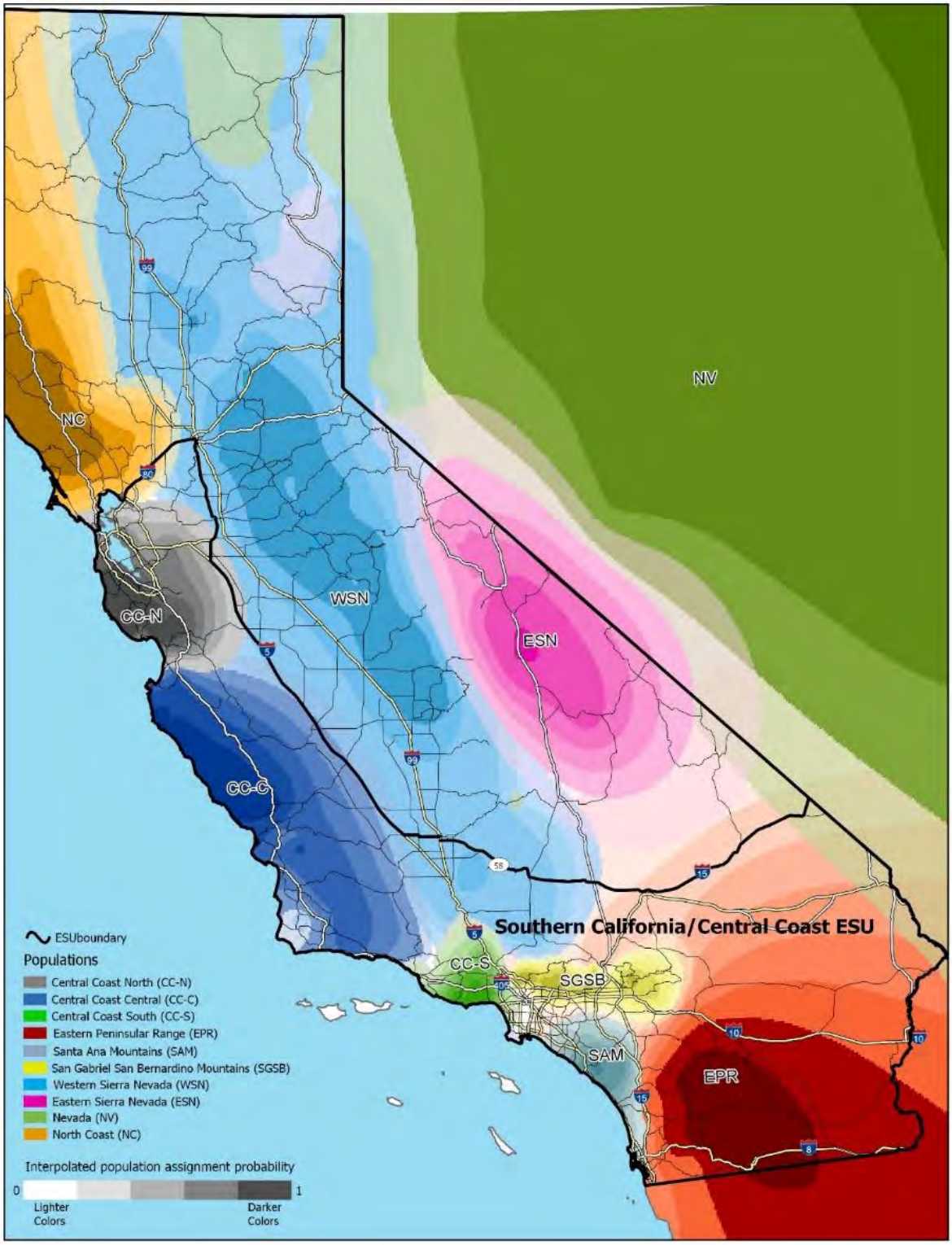

Figure 5. Map of the Southern California/Central Coast ESU boundary. Derived from Gustafson et al. (2018). Genetics data source: Kyle Gustafson, PhD, Department of Biology and Environmental Health, Missouri Southern State University, and Holly Ernest, DVM, PhD, Department of Veterinary Sciences, Program in Ecology, University of Wyoming, Laramie. Roads data source: ESRI.

We recommend including mountain lions in the Tehachapi and Sierra Pelona Mountains south of SR-58 in the Southern California/Central Coast ESU. While most mountain lions sampled from this region share some genetic affinities with Western Sierra Nevada (WSN) animals, individuals sampled in the Tehachapi Mountains and surrounding areas, including the Sierra Pelona Mountains in the Angeles National Forest and the Los Padres National Forest, had genetic structures made up of multiple genetic populations from the northern, central coastal, and southern populations (Figure 6). This area serves not just as a connecting link between mountain lion populations comprising the Southern California/Central Coast ESU, but also between this ESU and all other California mountain lions. The Tehachapi and Sierra Pelona Mountains are the last remaining linkages for statewide genetic connectivity and are critical for the overall genetic health of Southern California and Central Coast mountain lions. Consequently, mountain lions in these areas should be considered part of the listed entity.

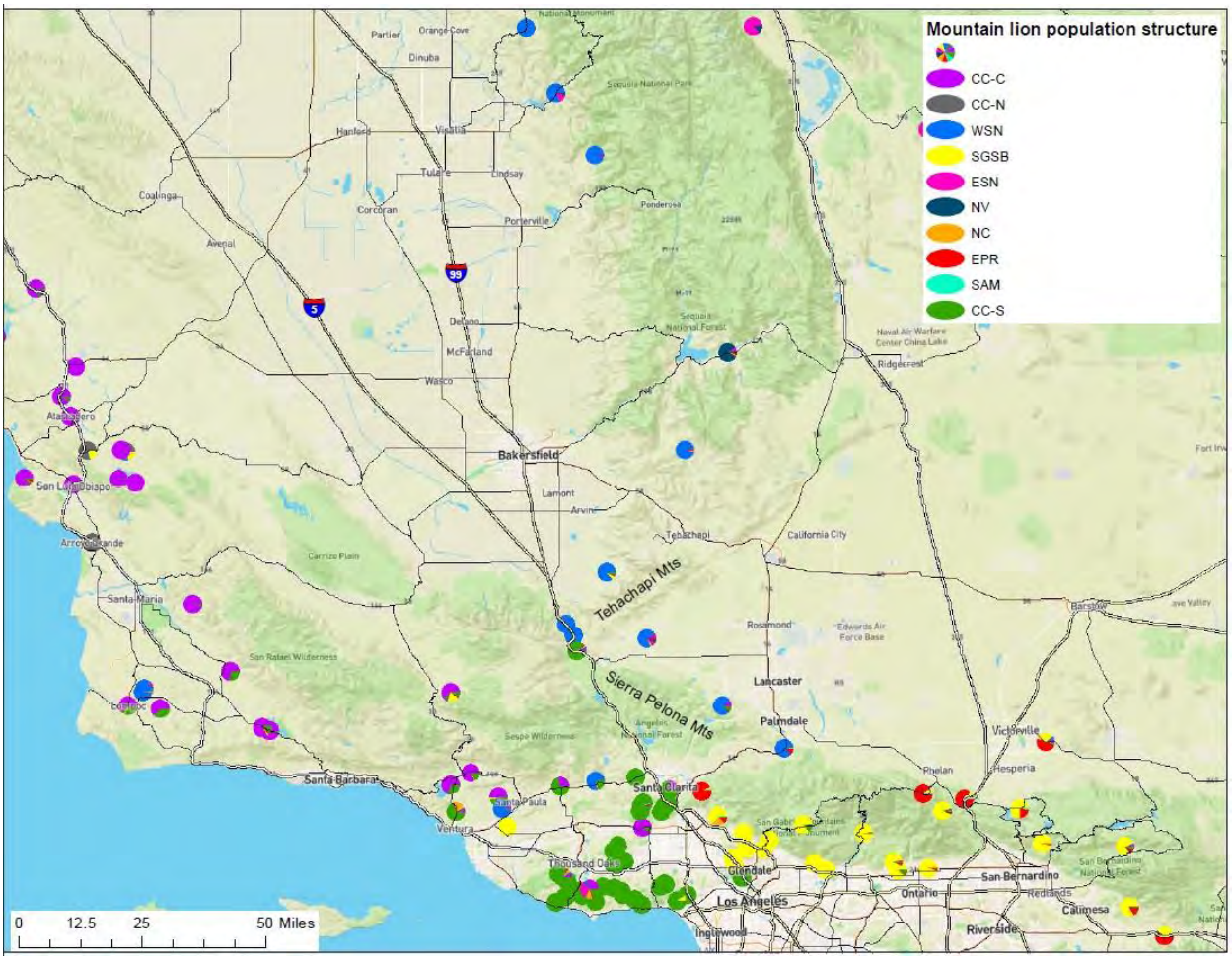

Figure 6. Map of mountain lion genetic structure in and surrounding the Tehachapi and Sierra Pelona Mountains, the last remaining linkage between the coastal, southern, and northern populations. Data source: Kyle Gustafson, PhD, Department of Biology and Environmental Health, Missouri Southern State University, and Holly Ernest, DVM, PhD, Department of Veterinary Sciences, Program in Ecology, University of Wyoming, Laramie.

3.4 Southern California and Central Coast Mountains Lions are Essential to the Region's Biodiversity

Additional support for designation of a Southern California/Central Coast ESU is provided by the fact that mountain lions are a keystone species critical to maintaining biodiversity in coastal California's ecosystems. The loss of these mountain lions—which are the only remaining large predator in the region—would lead to a trophic cascade wherein deer populations would increase and overgraze vegetation due to the lack of predation and lack of risk of predation, causing other repercussions to other species and habitats (Ripple and Beschta 2006; Ripple and Beschta 2008; Ripple et al. 2014). In addition, their kills are an important source of food for multiple terrestrial and avian scavengers (Ruth and Elbroch 2014; Elbroch et al. 2017; Barry et al. 2019).

Ripple and Beschta (2006) highlighted the critical role of mountain lions in western ecosystems by comparing habitat quality and the levels of biodiversity in two separate areas of Zion National Park – Zion Canyon, which mountain lions generally avoid due to high human presence, and North Creek, which mountain lions inhabit due to less human presence. The sustained lack of mountain lions in Zion Canyon has led to an unnaturally high density of deer, which has had profound impacts on Zion Canyon ecosystems. Ripple and Beschta (2006) observed Zion Canyon had low numbers of hydrophytic plants, wildflowers, amphibians, lizards, and butterflies while North Creek had significantly higher numbers in each of these categories.

North Creek riparian areas had well vegetated and stable banks while Zion Canyon lacked bank vegetation and its banks were continuing to erode (Ripple and Beschta 2006). The study noted that such geomorphic transformation of stream channels where mountain lions were absent were caused by plant loss on stream banks, which led to high levels of erosion and sedimentation, less shading and higher water temperatures, a larger width:depth ratio in streams, loss of hydrologic connectivity with historical floodplains, and loss of a wide variety of species, including native plants, benthic invertebrates, butterflies, fish, amphibians, and reptiles (Ripple and Beschta 2006).

The study concluded that removing a large carnivore from an ecosystem "appears to have [] profound effects on lower trophic levels, as well as multiple indicators of ecosystem status and native species abundance." (Ripple and Beschta 2006.) A similar study found that in Yosemite Valley—where mountain lions are largely absent due to high human presence—deer populations have expanded leading to a lack of oak recruitment and a decrease in biodiversity (Ripple and Beschta 2008). And their kills support disproportionately high levels of mammal, bird, and invertebrate diversity (Ruth and Elbroch 2014; Elbroch et al. 2017; Barry et al. 2019) and may even play a role in tree and other vegetation growth (Ruth and Elbroch 2014). In sum, extinction of Southern California and Central Coast mountain lions would result in degraded habitats and reduced abundance and diversity of other species, likely undermining the biological diversity, ecosystem function, and resilience of California's coastal regions.

3.5 Californians Derive Aesthetic, Recreational, and Economic Value from Southern California and Central Coast Mountain Lions

The people of California derive aesthetic, recreational, economic, spiritual, scientific, educational, and emotional value from Southern California and Central Coast mountain lions. For instance, the City of Los Angeles has designated October 22 as "P-22 day" to honor a young (and mate-less) male mountain lion that lives in Griffith Park and to acknowledge the importance of Southern California mountain lions to the region. Many people view mountain lions as a symbol of wildness and cherish landscapes that still are home to these predators. People from within and beyond the region choose to recreate, hike, bike, camp, fish, and hunt in California's wildlands in part because they enjoy exploring and sharing landscapes with mountain lions. And these activities are a significant economic driver for the state: A report commissioned for California State Parks found that direct outdoor recreation expenditures for Los Angeles, Southern California, the Central Coast and the San Francisco Bay Area totaled nearly $15 billion per year.[7] The Outdoor Industry Association concluded that outdoor recreation in California generates $92 billion of consumer spending annually and directly employs 691,000 Californians—more jobs than the wine and television industry combined.[8]

Mountain lions also provide an economic and social benefit because, by controlling deer populations, they reduce collisions between deer and automobiles. There are 1.2 million deer-vehicle collisions in the United States per year, incurring an estimated $1.66 billion in damages, 29,000 injuries, and 200 deaths (Gilbert et al. 2016). Impacts of deer-vehicle collisions are particularly severe in the eastern United States where white-tailed deer are overabundant. Gilbert et al. (2016) determined that if mountain lions recolonized the eastern United States, their presence would result in a 22 percent decline in deer-vehicle collisions over thirty years.

It is estimated that 7,000 to 23,000 wildlife vehicle collisions have occurred annually on California roads (Shilling et al. 2017; Shilling et al. 2018; State Farm Insurance Company 2016, 2018). These crashes result in human loss of life, injuries, emotional trauma, and property damages that can add up to $300-600 million per year (Shilling et al. 2018). If Southern California and Central Coast mountain lions became extinct, there would likely be a significant increase in deer-vehicle collisions in the region, along with associated human fatalities, injuries, and property damage.

An overabundance of deer in the eastern United States is also linked to an increase in ticks, which has led to increased incidences of Lyme disease among humans (Telford 2017; Côté et al. 2004). Lyme disease is now the most common vector-borne illness in the United States, with over 30,000 cases per year, primarily in the eastern United States.[9] Increases in deer abundance and attendant increases in ticks and tick-borne disease among humans would be

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[7] BBC Research & Consulting, *California Outdoor Recreation Economic Study: Statewide Contribution and Benefits* (2010), available at https://www.parks.ca.gov/pages/795/files/ca%20outdoor%20rec%20econ%20study-statewide%2011-10-11%20for%20posting.pdf.

[8] Outdoor Industry Association, *California Recreation Report*, available at https://outdoorindustry.org/wp-content/uploads/2017/07/OIA_RecEcoState_CA.pdf.

[9] Centers for Disease Control and Prevention, *Lyme Disease Data and Surveillance*, available at https://www.cdc.gov/lyme/datasurveillance/index.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Flyme%2Fstats%2Findex.html.

expected if Southern California and Central Coast mountain lions became extinct. Loss of Southern California and Central Coast mountain lions would have far-reaching effects not only on California's ecology, but also on public health and the region's economy.

Protection of Southern California and Central Coast mountain lions under CESA would confirm that this species is a vital member of our ecosystems which is worthy of protection. Conservation of these mountain lions would provide compelling evidence that large carnivores and abundant human populations can co-exist, even in densely populated landscapes (Benson et al. 2019).

4 Historical and Current Distribution

Mountain lions once had the most expansive range of any New World terrestrial mammal (Seidensticker 1991). They roamed most of the Americas (excluding most of Alaska and the northern areas of Canada) from approximately 50º N to 50ºS latitude and could be found from sea level to about 4,000m elevation (Young and Goldman 1946, Pierce and Bleich 2003) in habitats varying from dense forests, to dry deserts, savannahs, and swamp lands.

Due to habitat loss and hunting after the arrival of European colonists, the mountain lion's current range has been reduced to one third of its historical range in North America (Figure 7) (Culver et al. 2000; Pierce and Bleich 2003). In the United States, the species' range has been reduced to 15 western states and a small remnant population in Florida (endangered Florida panthers [*Puma concolor coryi*]), with isolated animals occasionally appearing in additional states. Continued hunting pressure and changes in land management practices have pushed most populations into mountainous, relatively unpopulated areas, though isolated populations are known to occur in more urban areas (Currier 1983; Gustafson et al. 2018).

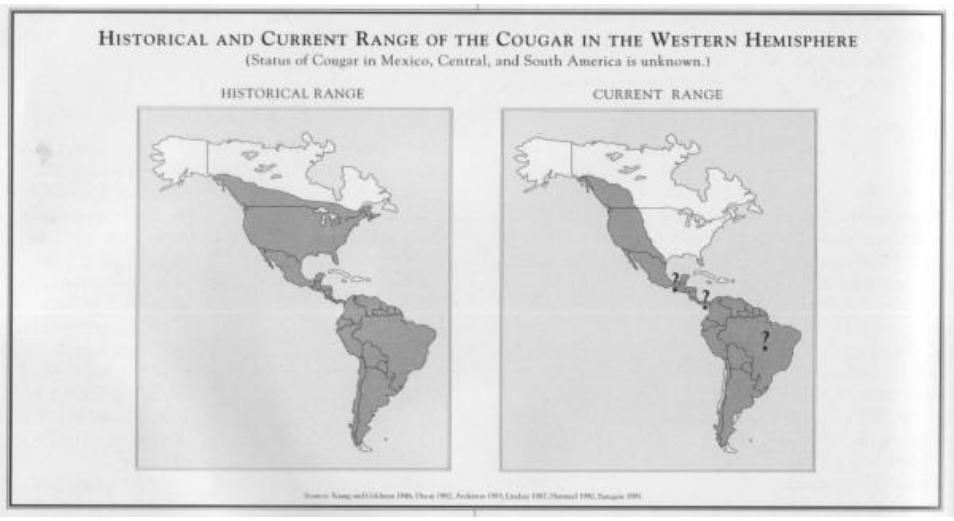


Figure 7. Historical and current range of mountain lions. Source: Hansen 1992.

In California, habitat fragmentation from roads and development has led to highly fragmented, divergent populations (Ernest et al. 2003; Ernest et al. 2014; Riley et al. 2014; Vickers et al. 2015; Gustafson et al. 2018). As mentioned in *Section 2.2 Taxonomy and Population Genetics*, nine genetically distinct populations have been identified within California

(Gustafson et al. 2018), with Southern California and Central Coast populations being the most constrained populations (and a tenth population centered in Nevada but extending slightly into California). Those located in highly urbanized areas of Southern California coastal mountain ranges, including the CC-S, SAM, and SGSB populations are especially restricted (Figure 8) (Vickers et al. 2015; Benson et al. 2016a; Gustafson et al. 2018; Benson et al. 2019).

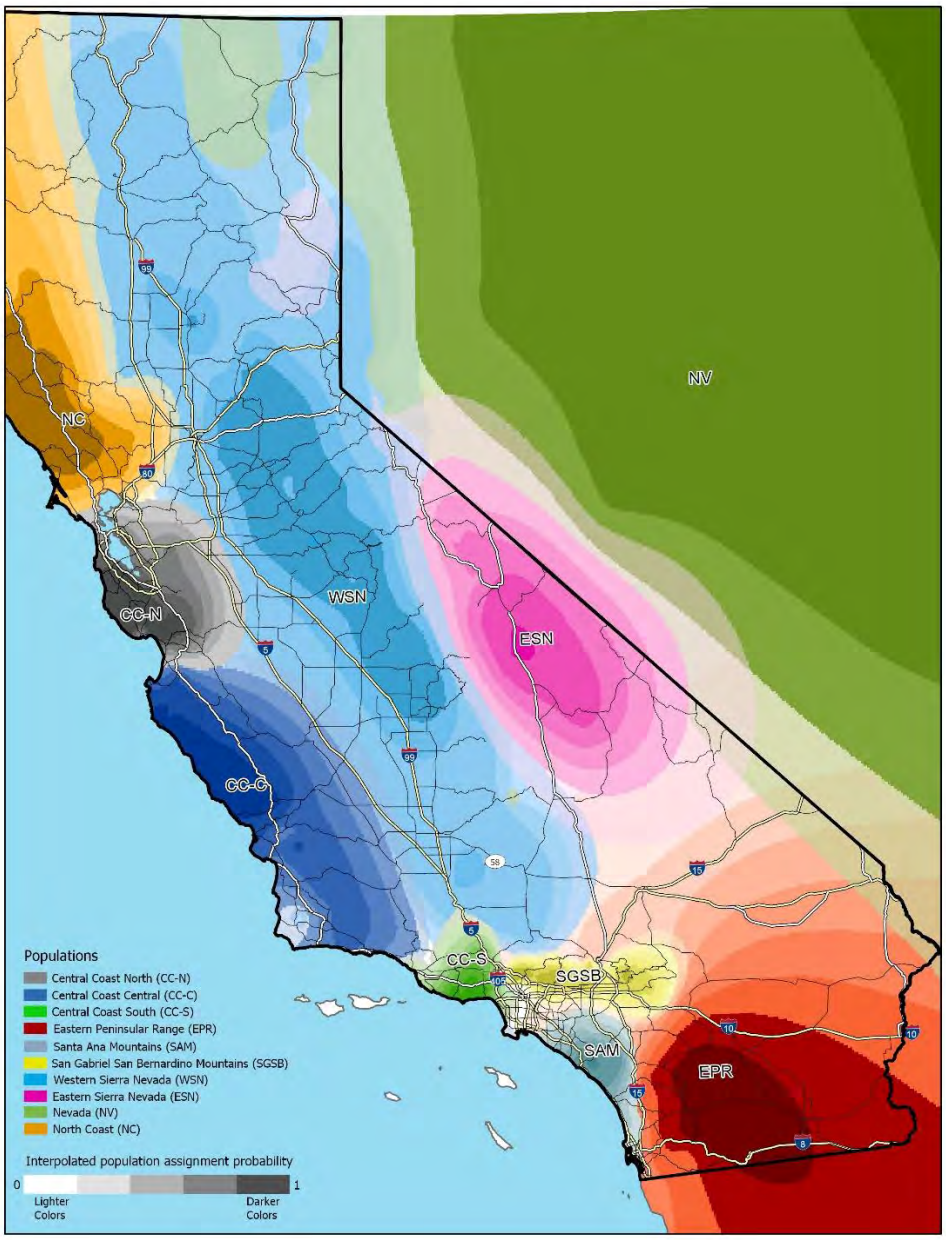


Figure 8. Map of genetically distinct mountain lion populations and major roads in California. The CC-S (which includes the Santa Monica Mountains), SGSB, and SAM populations are exceptionally constrained. The map is based on data collected from 1992-2016 (the division and status of these populations could change over time and with further research. Derived from Gustafson et al. (2018). Genetics data source: Kyle Gustafson, PhD, Department of Biology and Environmental Health, Missouri Southern State University, and Holly Ernest, DVM, PhD, Department of Veterinary Sciences, Program in Ecology, University of Wyoming, Laramie. Roads data source: ESRI.

4.1 Central Coast North (CC-N) Mountain Lion Population

The CC-N mountain lion population occurs mostly within the counties of Alameda, Contra Costa, San Mateo, Santa Clara, and Santa Cruz (Figure 8). The area is almost divided into two portions: an eastern half and a western half. The Santa Cruz Mountains make up the core area of the CC-N, bound by the Pacific Coast to the west, development lining the San Francisco Bay to the north and north west, and Highway 101 to the south. The eastern portion of the CC-N consists of various open space and nature preserves in the Berkeley Hills and Diablo Range bound by development lining the San Francisco Bay and Highway 101 and associated developments to the west, San Pablo Bay and Suisun Bay and associated developments to the north, I-5 to the east, and State Route 130 (SR-130) to the south. Interestingly, the CC-N seems almost bisected by the San Francisco Bay and Highway 101 and associated developments.

4.2 Central Coast Central (CC-C) Mountain Lion Population

The CC-C mountain lion population occurs mostly within the counties of Monterey, San Benito, San Luis Obispo, and Santa Barbara. The area encompasses the central and southern portions of the Southern Coast Ranges, including the Santa Lucia Range, Sierra de Salinas, the Temblor Range, and the Sierra Madre Mountains. It is bound by the Pacific Ocean to the west, Highway 101 and SR-156 and associated development to the north, the I-5 and San Joaquin Valley to the east, and SR-126 and associated developments to the south (Figure 8).

4.3 Central Coast South (CC-S) Mountain Lion Population

The CC-S mountain lion population is limited to the Santa Monica Mountains, Simi Hills, and the Santa Susana Mountains in Ventura and Los Angeles Counties (Figure 8). The Santa Monica Mountains population has the isolated area with about 660 km^2 within the Santa Monica Mountains National Recreation Area (Riley et al. 2014). The Pacific Ocean lies to the south while the cities of Oxnard, Thousand Oaks, San Fernando Valley, Los Angeles, and Santa Monica and major freeways including Highway 101, Interstate 5 (I-5) and Interstate 405 surround the area and create major movement barriers.

The Simi Hills is a smaller area of open space located north of the Santa Monica Mountains; the areas are bisected by Highway 101. This open space is mostly surrounded by development, including Simi Valley to the northwest, Thousand Oaks to the west, Agoura Hills to the southwest, Calabasas to the southeast, and Woodland Hills, Canoga Park, and Chatsworth to the east.

The Santa Susana Mountains are located north of the Santa Monica Mountains and Simi Hills. The area is generally bordered by freeways and the edges of development and agriculture. SR-118 borders the south and southwest, SR-126 borders the north and northwest, and I-5 borders the east.

4.4 San Gabriel/San Bernardino Mountains (SGSB) Mountain Lion Population

The SGSB mountain lion population occurs within the Transverse Ranges located northwest of the City of Los Angeles within Los Angeles, Kern, and San Bernardino Counties (Figure 8). The western and southern boundaries of the San Gabriel and San Bernardino Mountains are lined with urban developments and major freeways, including the San Fernando Valley, cities of San Bernardino, Rancho Cucamonga, and West Covina, and the I-5, I-210, and I-10 freeways. The northern and eastern boundaries of the area are abutted by agriculture, suburban development, high desert, and roads.

4.5 Santa Ana Mountains (SAM) Mountain Lion Population

The SAM mountain lion population inhabits about 1,533km^2 of undeveloped areas of the SAM within Orange, Riverside, and San Diego Counties (Beier and Barrett 1993; Benson et al. 2019). The area is mostly bound by major freeways and development (Figure 8). SR-241 creates the western boundary, SR-91 borders the northwest boundary, I-5 creates the eastern boundary, and agriculture and development border the southern extent. The closest intact habitat known to be used by other mountain lions is to the east/southeast, in the Peninsular Ranges.

4.6 Eastern Peninsular Range (EPR) Mountain Lion Population

The EPR mountain lion population occurs in mountain ranges east of the SAM and south of the San Bernardino Mountains. The EPR is a predominantly north to south range that runs through San Diego, Riverside, and Imperial Counties and the California-Mexico border. They include the San Jacinto, Laguna, and San Ysidro Mountains in California and continue south into the mountain ranges of Baja California, Mexico. The western boundary of the EPR population is lined with roads and urban development, including areas around the cities of Escondido, San Diego, and Chula Vista. Studies regarding the northern, southern, and eastern extent of the population are limited; however, movement patterns documented by Vickers et al. (2015) and Vickers et al. (2017) between 2001 and 2016 suggest that EPR mountain lions generally stay north of the U.S. – Mexico border, along the edges of the desert that borders the east side of the EPR, and south of I-10. Although the EPR population has been found to be largely disconnected from all other California populations, some mountain lion movement was documented traversing between the EPR and SGSB (Vickers et al. 2015), which would have occurred at the northern boundary of the EPR, and there is evidence of limited genetic exchange between the two populations (Gustafson et al. 2018). In addition, one young male mountain lion was documented to the south using the Parque-to-Park Linkage to cross the US-Mexico border several times (where the terrain is too rugged to install a border wall), but he was eventually killed in Mexico in a collision with a vehicle (Vickers et al. 2015; W. Vickers *unpublished data*). Little is known about the mountain lions south of the border, but the movement patterns of EPR mountain lions suggest that they may form a discrete population within the EPR north of the US-Mexico border (Vickers et al. 2015; Vickers et al. 2017).

5 Abundance and Population Trends

According to the International Union for Conservation of Nature (IUCN), mountain lion populations are decreasing throughout their remaining range (Nielsen et al. 2015). Mountain lion population densities are generally low, which may be driven by prey density, competition between males for access to females, and mutual avoidance (Pierce and Bleich 2003). In the United States, population densities for mountain lions have been found to range from 0.4 to 4.3 resident adults per 100km^2 and 0.4 to 7.1 total mountain lions per 100km^2, though it varies by population and the presence of human-induced pressures (*e.g.*, hunting) (Pierce and Bleich 2003). In California, where hunting has been outlawed but other anthropogenic pressures such as roads and development are present, resident adult and total population densities have been found to be 1.1 and 3.6 per 100 km^2, respectively (Pierce and Bleich 2003). Adult sex ratio has been reported to be about 2-3:1 in favor of females (Hornocker 1970; Seidensticker et al. 1973; Beier 1993; Santa Cruz Puma Project 2015). These low population densities and female-biased sex ratios further highlight the species' need for expansive, connected, heterogeneous habitats to support viable populations.

It has been estimated that 4,000 to 6,000 adult mountain lions roam California (Mansfield and Weaver 1989). However, CDFW acknowledges that this estimate from 1984 is outdated and relied on density estimates from regional studies to derive a statewide abundance. The agency has since declared that the number of mountain lions throughout the state is unknown, and they have embarked on an intensive statewide research project to better understand mountain lion numbers regionally and throughout the state.[10] Working with other agencies, academic institutions, and non-profits, CDFW plans to have statewide and region-specific mountain lion population estimates by 2022 (Vaughan 2018).

As mentioned in *Section 2.2 Taxonomy and Population Genetics*, one way in which the abundance of mountain lions can be estimated is with the ratio of effective to total adult population size (N_e/N) of 0.25 to 0.5, as was used by USFWS to generate an abundance estimate for the endangered Florida panther (Ballou et al. 1989; USFWS 2008). Using this method with the estimated effective population sizes of the nine genetically distinct mountain lion populations centered in California from Gustafson et al. (2018) and Benson et al. (2019), the statewide total population would be 818 to 1,634 individuals (255 to 510 in the Central Coast and Southern California populations [Table 1], and 563 to 1,124 in the remaining Eastern Sierra Nevada, Western Sierra Nevada, and North Coast populations), which is much lower than the 4,000 to 6,000 estimate. This is also well below the recommended minimum viable population size of at least 5,000 adult individuals for the long-term persistence of a population (Frankham 1995; Reed et al. 2003; Traill et al. 2010). Petitioners recognize that the N_e/N methodology has limitations and is but one method of generating an overall abundance estimate. More studies are needed to determine regional and statewide mountain lion abundance, including CDFW's ongoing efforts which should produce a more scientifically robust statewide abundance estimate.

[10] CDFW 2018 - Commonly Asked Questions About Mountain Lions. Accessed on 11 April 2019 at: https://www.wildlife.ca.gov/Conservation/Mammals/Mountain-Lion/FAQ#359951241-how-many-mountain-lions-are-in-california

Despite unknown statewide population estimates, researchers have been closely tracking several of the Central Coast and Southern California populations. Through their published studies and reports they provide some insights regarding abundance and population trends for these populations.

5.1 Central Coast North (CC-N) Mountain Lion Population

Studies on the CC-N mountain lion population are limited, and abundance and population trends are unknown. However, with an effective population size of 16.6 (Gustafson et al. 2018), and an N_e/N of 0.25 to 0.5 (Ballou et al. 1989; USFWS 2008), the estimated total adult population would be 33 to 66 individuals (see Table 1). As mentioned previously in *Section 2.2 Taxonomy and Population Genetics*, these numbers are grossly insufficient to prevent inbreeding depression in the short term or maintain evolutionary potential in the long term (Jamieson and Allendorf 2012; Frankham et al. 2014).

Gustafson et al. (2018) found that this population has low genetic diversity and a low effective population size, which suggests that it is at increased risk of inbreeding depression within five generations and eventual extinction. Ongoing studies in the Santa Cruz Mountains highlight high levels of human-caused mortalities. Depredation kills are the leading cause of death in collared mountain lions in the Santa Cruz Mountains (Wang et al. 2017), and CDFW reported 34 depredation kills between 2010 and 2016 in the CC-N counties of Alameda, Contra Costa, San Mateo, Santa Clara, and Santa Cruz (see Appendix A[11]). In addition, at least six mountain lions have been killed by vehicle strikes on Highway 17 in the Santa Cruz Mountains between 2008 and 2018 (Midpensinsula Regional Open Space 2017; Slade 2018) and news outlets reported at least three mountain lions killed by vehicle strikes on the I-280 in San Mateo County between 2014 and 2016 (Wilmers 2014, CBS SF 2015, Kamala 2016). The poor genetic health of the CC-N population is likely due to habitat fragmentation and isolation caused by roads and development combined with high levels of human-caused mortalities. CDFW has identified the Santa Cruz Mountains population as at risk due to current habitat and genetic concerns, at-risk internal habitat and connectivity, limited external connectivity, and lack of protected habitat (Dellinger 2019). Poor connectivity and continued development in the CC-N will likely lead to further isolation, increased human-caused mortalities, decreased genetic diversity, and increased risk of extinction in the foreseeable future.

5.2 Central Coast Central (CC-C) Mountain Lion Population

Studies on the CC-C mountain lion population are limited, and abundance and population trends are unknown. However, with an effective population size of 56.6 (Gustafson et al. 2018), and an N_e/N of 0.25 to 0.5 (Ballou et al. 1989; USFWS 2008), the estimated total adult population would be 113 to 226 individuals (see Table 1).

Although Gustafson et al. (2018) found that this population has intermediate levels of genetic diversity and the highest effective population size among the Central Coast and Southern

[11] These data were downloaded from the CDFW website; however, they no longer appear to be available online. These numbers have been shown to be low by a factor of two in some areas, likely due to incomplete reporting, and therefore should be considered absolute minimums (W. Vickers, *pers comm*).

California mountain lion populations, with an effective population size of 56.6, it just barely exceeds the older standard of 50 to prevent inbreeding depression in the short-term (Frankham et al. 2014; Gustafson et al. 2018). In addition, it falls well below the recommended newer standard of 100 and is insufficient for the long-term viability of the population (Frankham et al. 2014). And the lack of sufficient protected lands and high rates of development in the area threaten the persistence of this population (Dellinger 2019). Thus, although the CC-C population appears to be the healthiest population in the Central Coast and Southern California, it is still at increased risk of inbreeding depression and extinction, and connectivity to smaller adjacent areas should be improved (Dellinger 2019).

5.3 Central Coast South (CC-S) Mountain Lion Population

The NPS has been studying the CC-S population since 2002, though most studies regarding population dynamics focus on the Santa Monica Mountains mountain lions (Riley et al. 2014; Benson et al. 2019). Since 2002, NPS has collected data from 55 mountain lions within the Santa Monica Mountains and 19 mountain lions from the Simi Hills and Santa Susana Mountains.[12] There are currently 20-25 live mountain lions being tracked in the Santa Monica Mountains, 7-12 of which are adults (born in 2014 or earlier, the status of 5 adults are unknown) and 13 of which are juveniles or subadults (born in 2015 or later).[13] Given that the Santa Monica Mountains area is relatively small, adult survival rate is high (≥ 75%), and juvenile/subadult survival is low due to intraspecific strife and the inability to disperse, the Santa Monica Mountains population is likely space-limited and these numbers may represent the Santa Monica Mountains' carrying capacity (Riley et al. 2014; Benson et al. 2019). As mentioned previously in *Section 2.2 Taxonomy and Population Genetics*, the extremely low effective population size and total adult population size are grossly insufficient to prevent inbreeding depression in the short term or maintain evolutionary potential in the long term (Jamieson and Allendorf 2012; Frankham et al. 2014). And CDFW has identified the CC-S population as at risk due to current habitat and genetic concerns, at-risk internal habitat and connectivity, limited external connectivity, and lack of protected habitat (Dellinger 2019).

The long-term survival of the Santa Monica Mountains population is severely threatened due to extreme habitat fragmentation and isolation caused by surrounding roads and development that impede movement in or out of the area (Riley et al. 2014). Limited space and lack of connectivity with suitable mountain lion habitat inhibit dispersal for subadults and likely drive unusually high levels of intraspecific strife, which is the most common cause of mortalities in the

[12] The NPS provides puma profiles (last updated August-November 2018) of the marked animals (*i.e.*, tagged or radio-collared) they have been studying in the CC-S, which includes those studied in Riley et al. (2014). Some data presented in this section take these data into account. Accessed on 3 April 2019 at: https://www.nps.gov/samo/learn/nature/puma-profiles.htm.

[13] The adult population in the Santa Monica Mountains is generally consistent with the estimated 0.25 to 0.5 N_e/N; the Santa Monica Mountains was estimated to have an effective population size of four (Benson et al. 2019), which would suggest a total adult population size of 8 to 16. Interestingly, Gustafson et al. (2018) estimated an effective population size of 2.7 for the greater CC-S population, which would indicate a total adult population of 5 to 10 individuals throughout the Santa Monica Mountains, Simi Hills, and Santa Susana Mountains (see Table 1). There are currently 10 to 17 adult mountain lions being tracked throughout the CC-S area, which would put their N_e/N ratio at 0.16 to 0.27, which is still within the range of other species' N_e/N ratios (Frankham et al. 1995; Ballou et al. 1989; Mace and Lande 1991; Spong et al. 2000; Laundré and Clark 2003).

area (Riley et al. 2014). Although intraspecific strife is known to occur among mountain lions, there have been multiple cases of aggressive adult males killing their siblings, female offspring, and previous mates documented in the Santa Monica Mountains population, and researchers noted that "clearly this is rarely a sound evolutionary strategy as the survivorship of offspring or siblings is traded against the probability of future reproduction" (Riley et al. 2014). For 23 radio-collared individuals within the Santa Monica Mountains for which the cause of death is known, nine deaths were the result of instraspecific strife. Eight of the nine deaths (89%) were of animals less than four years old. In addition, three uncollared mountain lions in the Santa Monica Mountains less than four years old were found dead by intraspecific strife, which brings the total to 12 deaths by intraspecific strife documented in the Santa Monica Mountains between 2002 and 2018.

Although all subadult males and half of subadult females typically disperse from their natal areas (Logan and Sweanor 2010), only one subadult successfully dispersed from the Santa Monica Mountains between 2002 to 2012 – P-22, the famous male mountain lion who successfully crossed Highway 101 and I-405 freeways and established his home range in Griffith Park (Riley et al. 2014). Unfortunately, P-22 is extremely isolated with the smallest home range ever reported for an adult male ($26km^2$), and he has not had any opportunities to mate (Riley et al. 2014). In addition, vehicle strikes account for 17% (4/23) of known radio-collared mountain lion deaths in the Santa Monica Mountains. According to the NPS, most males in the Santa Monica Mountains do not live past the age of two. Thus, many healthy, young animals are not able to disperse from the Santa Monica Mountains, establish their own home ranges, and successfully reproduce.

Conversely, lack of connectivity also inhibits migrants coming from outside the Santa Monica Mountains and contributing to the population's gene pool. Only two outside mountain lions have been known to immigrate into the Santa Monica Mountains since 2002: P12 (from Simi Hills, alive as of August 2018, age 12) and P45 (from north of Highway 101, status unknown, age would be 6-7 if alive). While there has been no sign of P-45 since February, 2019 and no offspring from him have been detected, P-12 has been fairly prolific in the Santa Monica Mountains, fathering at least eight litters. Although P-12's appearance initially improved genetic diversity in the Santa Monica Mountains population, consistent immigration in small populations is needed so that the genetic diversity gains of immigrant mountain lions are not lost (Riley et al. 2014; Benson et al. 2016a; Benson et al. 2019). Subsequent inbreeding by P-12 with his daughters and granddaughters and inbreeding already occurring with other breeding adults in the Santa Monica Mountains have led to dangerously low genetic diversity (Riley et al. 2014; Benson et al. 2016a; Gustafson et al. 2018; Benson et al. 2019). With continued isolation, inbreeding, and loss of genetic diversity, there is increasing risk of inbreeding depression and extinction. With inbreeding depression, the probability of extinction within 50 years is predicted to be 99.7 %, with a median time to extinction of 15.1 years (Benson et al. 2016a; Benson et al. 2019).

5.4 Santa Ana Mountains (SAM) Population

Restricted habitat availability and high mortality rates in the SAM likely limits population size, and Benson et al. (2019) estimated that the SAM population is likely comprised of 16 adults and 13 juveniles (kittens and subadults). These numbers are slightly lower than the 31 to 62 adult mountain lions estimated from the SAM population's effective population size of 15.6 (Gustafson et al. 2018) (see Table 1). According to (Benson et al. 2019), high levels of human-caused adult mortalities may limit growth potential in the SAM, and it is uncertain if the population could be larger without as many anthropogenic pressures. In fact, although hunting is illegal in California, mountain lions in Southern California have a lower annual survival than many hunted populations (Vickers 2014). Interestingly, other studies calculated a much lower effective population size of 5.1 (Ernest et al. 2014) and four (Benson et al. 2019), which would align with the suggested carrying capacity. Regardless of which effective population size is used, they are all well below the frequently-used threshold of 50 and insufficient to prevent inbreeding depression in the short-term.

Although population trends are unclear, two long-term studies on radio-collared mountain lions in the SAM provide some insight (Beier 1993; Vickers et al. 2015). In a study that consisted of 32 radio-collared animals in the SAM from 1988 to 1993, researchers found a 75% adult survival rate (Beier and Barrett 1993), which is similar to adult survival rates in other populations, like the CC-S population (Riley et al. 2014). However, in a second, more recent study conducted in the area consisting of 31 marked mountain lions from 2001 to 2013, researchers found a 56.5% survival rate across all sexes and age groups (Vickers et al. 2015). The marked decrease in adult survival rate between the two studies coincides with an increase in the proportion of mortalities caused by vehicle strikes, with the 1988-1993 and the 2001-2013 studies resulting in 32% (10/31) and 46% (6/13) of deaths caused by vehicle strikes, respectively (Beier 1993; Vickers et al. 2015). It also parallels an upward trend of mountain lion mortalities caused by vehicle strikes throughout Southern California over time (Vickers et al. 2015). Other causes of death in the SAM population included depredation kills, illegal killing, disease, intraspecific strife, and human-caused wildfires (Beier and Barrett 1993; Vickers et al. 2015). Depredation kills were found to be 3.4 times more likely with males compared to females (Vickers et al. 2015).

The SAM mountain lion population's high adult mortality rates combined with isolation, small size, low genetic diversity, low effective population size, and limited immigration of new individuals cause demographic instability and put the population at high risk of extinction (Beier 1993; Beier and Barrett 1993; Ernest et al. 2014; Vickers et al. 2015; Gustafson et al. 2017; Gustafson et al. 2018; Benson et al. 2019). As mentioned previously in *Section 2.2 Taxonomy and Population Genetics*, the extremely low effective population size and total adult population size are insufficient to prevent inbreeding depression in the short term or maintain evolutionary potential in the long term (Jamieson and Allendorf 2012; Frankham et al. 2014). Roads and development prevent dispersal and sustained immigration in the SAM, and lack of consistent gene flow has led to high levels of inter-relatedness and inbreeding (Ernest et al. 2014; Gustafson et al. 2017; Gustafson et al. 2018; Benson et al. 2019). Further genetic erosion is likely without improved connectivity to facilitate immigration (Benson et al. 2019). CDFW has identified the SAM population as at risk due to current habitat and genetic concerns, at-risk internal habitat and

connectivity, limited external connectivity, and lack of protected habitat (Dellinger 2019). If inbreeding depression occurs within this population, population growth will likely decline and the probability of extinction within 50 years is predicted to be 100%, with a median time to extinction of 11.7 years (Benson et al. 2019).

In 13 years, only one radio-collared individual crossed I-15, the major barrier between the SAM and the EPR, and that animal was killed 25 days after his crossing for depredating domestic sheep (Vickers et al. 2015). And although Gustafson et al. (2017) documented three males immigrating into the SAM from the EPR and four males emigrating from the SAM to the EPR over a 15-year period, only one of the males (M86, an immigrant to the SAM) is known to have successfully bred. While M86 improved the SAM population's genetic diversity (Gustafson et al. 2017), high levels of mortalities due to vehicle strikes and depredation/illegal killings likely reduce the number of immigrants that can successfully establish as breeding adults (Vickers et al. 2015). With high levels of adult mortalities due to vehicle strikes, depredation kills affecting 3.4 times more males than females, and a small population with a female-biased adult sex ratio, there is potential for occasional male extinction in the SAM, which could severely limit the short- and long-term viability of the population (Beier and Barrett 1993; Benson et al. 2019).

5.5 San Gabriel/San Bernardino Mountains (SGSB) Population

Studies on the SGSB mountain lion population are limited, and the abundance and population trends are unknown. However, with an effective population size of 5 (Gustafson et al. 2018), and an N_e/N of 0.25 to 0.5 (Ballou et al. 1989; USFWS 2008), the estimated total adult population would be 10 to 20 individuals (see Table 1). As mentioned previously in *Section 2.2 Taxonomy and Population Genetics*, these numbers are grossly insufficient to prevent inbreeding depression in the short term or maintain evolutionary potential in the long term (Jamieson and Allendorf 2012; Frankham et al. 2014). And CDFW has identified the SGSB population as at risk due to current habitat and genetic concerns, at-risk internal habitat and connectivity, limited external connectivity, and lack of protected habitat (Dellinger 2019).

Although a population viability study has not been conducted for the SGSB population, given its low genetic diversity, low effective population size, and patterns of isolation due to roads and development creating movement barriers (Gustafson et al. 2018), the SGSB mountain lion population likely has high risk of inbreeding depression and extinction. The loss of this population could undermine genetic connectivity for mountain lions statewide because the SGSB population, along with the Tehachapi and Sierra Pelona Mountains, represents a critical linkage between mountain lion populations in the northern and southern mountain ranges of California (Gustafson et al. 2018). Restoration and enhancement of connectivity in the SGSB and surrounding mountain ranges are key for the continued survival of the SGSB population as well as all of the Central Coast and Southern California mountain lion populations.

5.6 Eastern Peninsular Range (EPR) Population

Studies on the EPR mountain lion population are limited and the abundance and population trends are unknown. However, with an effective population size of 31.6 (Benson et al. 2019), and an N_e/N of 0.25 to 0.5 (Ballou et al. 1989; USFWS 2008), the estimated total adult

population would be 63 to 126 individuals (see Table 1). As mentioned previously in *Section 2.2 Taxonomy and Population Genetics*, these numbers are insufficient to prevent inbreeding depression in the short term or maintain evolutionary potential in the long term (Jamieson and Allendorf 2012; Frankham et al. 2014).

Vickers et al. (2015) followed 43 marked mountain lions in the EPR from 2001 to 2013, and their study provides some insight regarding survival rate and causes of mortality. Annual survival rate was found to be 55.4% in the EPR, which is similar to the SAM population (Vickers et al. 2015). The primary causes of death of marked mountain lions were depredation kills (26% [6/23]) and vehicle strikes (17% [4/23]). When assessing mountain lion death data from CDFW from 1981 to 2013, depredation and vehicle strikes accounted for about 70% of mountain lion deaths in the EPR: 40% (62/154) by depredation kills and 30% (46/154) by vehicle strikes (Vickers et al. 2015).

Although the EPR population was found to have the highest genetic diversity and effective population size among the Southern California mountain lion populations (Gustafson et al. 2018), movement and genetic studies have shown that the EPR population is largely disconnected from all other California populations (Ernest et al. 2014; Vickers et al. 2015; Vickers et al. 2017; Gustafson et al. 2018). And CDFW has identified the EPR population as at risk due to current habitat and genetic concerns, at-risk internal habitat and connectivity, limited external connectivity, and lack of protected habitat (Dellinger 2019). Thus, high human-caused mortality rates combined with continued development in San Diego, Riverside, and Imperial Counties could lead to further isolation, decreased genetic diversity, increased inbreeding depression, and increased risk of extinction.

6 Factors Affecting Ability to Survive and Reproduce

Female mountain lion, P-23, crossing a road in the Santa Monica Mountains. She was struck by a vehicle and found dead near Malibu Canyon Road in January 2018. Photo: NPS

Most, if not all, factors affecting the ability of the Southern California and Central Coast mountain lion populations to survive and reproduce are caused by humans. Lack of wildlife connectivity is the primary driver of their potential demise. Habitat loss and fragmentation due to roads and development have led to extreme levels of isolation and high mortality rates, which are driving these populations towards extinction. Continued development in current suitable

mountain lion habitat further threatens these populations. With low genetic diversity and high risk of inbreeding depression due to genetic isolation, vehicle strikes on roads, increased conflicts with humans that lead to depredation kills, high levels of intraspecific strife likely due to limited space and lack of connectivity, rodenticide and other environmental toxicant poisoning, and impacts of more frequent wildfires and climate change, Southern California and Central Coast mountain lions will likely not persist unless there is a concerted effort to restore and enhance functional connectivity between populations and large blocks of heterogeneous habitats.

The populations in Southern California are especially vulnerable to extinction, which is reflected in a 2005 review conducted by the US Forest Service regarding Land Management Plans in the National Forests of Southern California that states the "greatest concern for the long-term health of mountain lion populations on the national forests of southern California is loss of landscape connectivity between mountain ranges and large blocks of open space on private land." [14] The review emphasizes that continued development along with new and wider roads degrade habitat linkages and create movement barriers, and "[w]ithout the national forests and linkages between the mountain ranges and other large habitat preserves, there is not much long term potential for mountain lions in southern California."

Ultimately, the persistence of mountain lions in the Central Coast and Southern California requires maintenance and restoration of connectivity between subpopulations and adequate habitat. The extreme isolation, dangerously low genetic diversity, high levels of inbreeding, and high rates of human-caused mortalities (*e.g.*, vehicle strikes, depredation kills, intra-specific strife due to limited space, rodenticide poisoning, etc.) underscore the urgent need for proactive measures to enhance connectivity (Ernest et al. 2014; Riley et al. 2014; Vickers et al. 2015; Benson et al. 2016a; Gustafson et al. 2017; Benson et al. 2019).

Male mountain lion M110 in San Diego County was euthanized by a CDFW warden because he was severely injured and for stated public safety concerns (he was found in a neighborhood close to homes). This occurred days after he was illegally shot by a livestock owner (open wound on right flank). Necropsy results indicated he had two broken legs consistent with a vehicle strike and four different compounds of anticoagulant rodenticides in his blood. Had he not been euthanized, he likely would have died from starvation due to his injuries. Source: Vickers (2014).

[14] Forest Service, U.S. Department of Agriculture, *Final Environmental Impact Statement, Land Management Plans, Angeles National Forest Cleveland National Forest Los Padres National Forest San Bernardino National Forest* (Sept. 2005), available at https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5166889.pdf.

Measures to conserve core habitat areas and functional wildlife corridors, like the recently adopted Habitat Connectivity and Wildlife Movement Ordinances in Ventura County,[15] are vital to the preservation of Central Coast and Southern California mountain lion populations, but just protecting land is not enough to ensure their survival. Conserving natural habitats on both sides of freeways and constructing effective crossing infrastructure (*e.g.*, culverts, underpasses, vegetated overpasses, and exclusionary fencing) at existing roads and barriers would facilitate movement and gene flow while reducing mortalities due to vehicle strikes (Riley et al. 2014; Vickers et al. 2015; Benson et al. 2019). Promoting wider implementation of predator-proof enclosures for domestic animals would further reduce human-caused mortalities by limiting opportunities for potential conflict and reducing the use of depredation permits (Vickers et al. 2015). In addition, changes in depredation permit policy could further reduce mortalities. For example, CDFW adopted a new depredation permit policy based on a 2017 bulletin for mountain lions in the CC-S and SAM areas, which requires affirmative non-lethal alternatives and improved husbandry before kill permits are issued when mountain lion depredations occur in those areas (CDFW 2017; see *Section 8.1.1 CDFW Departmental Bulletins*). Expanding these policies in conjunction with enforceable implementation and reporting requirements across the state, or at least into the SGSB, EPR, CC-N, and CC-C, population areas, would reduce mortalities from this source. Prohibiting the use of second-generation anticoagulants, rodenticides, and other environmental toxicants in California (*i.e.*, with AB 1788, sponsored by Assembly Member Richard Bloom in 2019) would even further reduce human-caused mortalities of mountain lions, as toxicants bioaccumulate up the food chain and can kill mountain lions or weaken their immune systems and make them more susceptible to disease or more vulnerable to conspecifics (Riley et al. 2003; Riley et al. 2007; Serieys et al. 2015). A combination of habitat conservation, implementation of effective road/barrier crossing infrastructure, and outreach and education to property owners and owners of domestic animals combined with depredation permit policy change could save these populations from extinction (Vickers et al. 2015).

6.1 Low Genetic Diversity and Inbreeding Depression

As detailed in *Section 2.2 Taxonomy and Population Genetics* and *Section 5.0 Abundance and Population Trends*, inbreeding is a serious threat to the persistence of the Central Coast and Southern California mountain lion populations. Inbreeding depression, loss of genetic diversity, and accumulation of deleterious mutations can lead to elevated extinction risk due to reduced reproductive fitness and evolutionary potential (*i.e.*, the ability to adapt to change) (Spielman et al. 2004; Frankham 2005; Traill et al. 2010). Decades of isolation due to roads and development fragmenting habitat and limiting connectivity has led to low genetic diversity and effective population sizes, high levels of inter-relatedness, and dangerous levels of inbreeding, especially in the CC-S, SAM, SGSB, and CC-N populations (Ernest et al. 2014; Riley et al. 2014; Vickers et al. 2015; Benson et al. 2016a; Gustafson et al. 2017; Gustafson et al. 2018; Benson et al. 2019). Although demographic and environmental stochasticity (*e.g.*, a disease outbreak, wildfire, drought or flooding) can increase risk of extinction, especially in small populations, inbreeding has also been shown to be an indicator of extinction risk and may impact how populations are able to respond to stochastic events (Frankham and Ralls 1998). In addition, endangered species

[15] More information regarding the Habitat Connectivity and Wildlife Movement Ordinances available at: https://vcrma.org/habitat-connectivity-and-wildlife-movement-corridors

tend to have lower genetic diversity than non-endangered species, which suggests that inbreeding and low genetic variation may have an important role in a species' risk of extinction (Frankham and Ralls 1998). Thus, genetic factors should be considered when assessing the status of these populations.

The CC-S, SAM, SGSB, and CC-N populations have been found to have low genetic diversity, with the SAM population's genetic variation nearly as low as the endangered Florida panther's (*Puma concolor coryi*) (Ernest et al. 2014; Riley et al. 2014; Gustafson et al. 2017). And, as mentioned previously in *Section 2.2 Taxonomy and Population Genetics*, the CC-S, SGSB, SAM, CC-N, and EPR populations have effective population sizes well below the older and less conservative threshold of 50, while the CC-C population's effective population size is just barely above that threshold at $N_e = 56.6$ (Ernest et al. 2014; Riley et al. 2014; Benson et al. 2016a; Gustafson et al. 2018; Benson et al. 2019). These numbers suggest that inbreeding depression could occur within the short-term (over the duration of five generations) and these populations are at increased risk of extinction.

Without improved connectivity, the SAM and Santa Monica Mountains (within the CC-S) populations are predicted to experience continued genetic erosion and losses in heterozygosity of 28-49% and 40-57%, respectively, within 50 years (Benson et al. 2016a; Benson et al. 2019). This could lead to inbreeding depression, which could cause reduced fitness in a variety of ways. In Florida panthers, inbreeding depression led to reproductive issues (*e.g.*, poor sperm quality, low testosterone levels, poor fecundity and recruitment, failure of testes to descend), increased susceptibility to parasites and disease, and physical issues (*e.g.*, atrial septal defect, a deadly congenital heart defect; kinked tails) (Roelke et al. 1993; Johnson et al. 2010). Suffering from shrinking, fragmented habitats, high mortality rates from hunting, and inbreeding depression, the Florida panther population declined to less than 30 individuals, and genetic restoration via the translocation of eight female mountain lions from Texas (*Puma concolor stanleyana*) was needed to prevent their extinction (Johnson et al. 2010).

The SAM and CC-S populations are severely constrained in fragmented habitats with similar numbers as the Florida panther population prior to genetic rescue (Beier and Barrett 1993; Johnson et al. 2010; Riley et al. 2014; Vickers et al. 2015). Although the fragmented populations appear to be stable, high levels of inbreeding have been documented in the Santa Monica Mountains (Riley et al. 2014) and evidence of inbreeding depression (*i.e.*, low genetic diversity and kinked tails) has been observed in the SAM (Ernest et al. 2014). If these populations remain isolated, they will inevitably have the same fate as the Florida panthers. Researchers predict that with inbreeding depression, the SAM and Santa Monica Mountains populations have a 100% and 99.7% chance of becoming extinct within 50 years, with median time to extinction of 11.7 and 15.1 years, respectively (Benson et al. 2019).

The SGSB population was also found to have low genetic diversity and effective population size (Gustafson et al. 2018), which suggests that the population experienced a prior genetic bottleneck and inbreeding is likely. Although genetic studies on this population are limited, it is clear that continued development in and around the SGSB will further isolate the population and lead to more inbreeding and even lower genetic diversity, which will drive the population faster towards extinction. It is important to note that despite only limited gene flow

between the SGSB population and the Western Sierra Nevada, CC-C, and the EPR (Gustafson et al. 2018), this population represents a critical linkage between mountain lion populations in the northern and southern mountain ranges of California. Restoration and enhancement of connectivity is key for the continued survival of the SGSB population as well as all of the other the Central Coast and Southern California mountain lion populations.

Gustafson et al. (2018) found that the EPR population also exhibits a prior genetic bottleneck. The EPR population was found to be largely disconnected from all the other California populations, with limited gene flow and low connectivity with the SAM and SGSB populations (Gustafson et al. 2018). Movement patterns and genetics indicate potential isolation from other populations (Vickers et al. 2015; Gustafson et al. 2017; Gustafson et al. 2018), and continued development in these areas will likely lead to further isolation, genetic drift, and risk of extinction similar to what is being observed in the CC-S, SAM, and SGSB populations.

Although genetic studies are limited for the CC-N population, it was found to have low genetic diversity and low effective population size (Gustafson et al. 2018), which forewarns of inbreeding depression and increased risk of extinction. CDFW has identified the Santa Cruz Mountains mountain lion population, which occurs within the CC-N area, as vulnerable to decline and extinction due to fragmentation from roads and development as well as lack of protected habitat (Dellinger 2019).

Studies suggest that one immigrant every 1-2 years would reduce extinction risk in the SAM and Santa Monica Mountains populations (Beier and Barrett 1993; Gustafson et al. 2017; Benson et al. 2019). This may apply to the other populations with low genetic diversity and effective population size (Gustafson et al. 2018). Increasing connectivity throughout the Central Coast and Southern California would address issues of inbreeding by facilitating movement between populations, increasing effective population size, and reducing high mortality rates driven by vehicle strikes and depredation. Thus, proactive measures to effectively restore and enhance connectivity are needed to minimize risk of inbreeding depression and extinction in Central Coast and Southern California populations.

6.2 Vehicle Strikes

In California, an estimated 100 mountain lions are killed every year by vehicle strikes (Pollard 2016). In the Central Coast and Southern California, vehicle strikes represent a significant threat to the persistence of mountain lion populations, though Southern California has more documentation regarding this issue. The number of mortalities caused by vehicle strikes has been increasing in Southern California since the 1980s, and vehicle strikes account for a high proportion of deaths in mountain lions in the SAM, CC-S, and EPR (Beier and Barrett 1993; Riley et al. 2014; Vickers et al. 2015:Vickers et al. 2017). From 1981 to 2013 vehicle strikes accounted for 53% (50/94) of mountain lion deaths in the SAM and 30% of mountain lion deaths in the EPR (46/154) (Vickers et al. 2015). Riley reported that 14% (2/14) of collared mountain lion deaths from 2002 to 2012 were due to vehicle strikes, and the NPS reported that 18 mortalities from vehicle strikes occurred between July 2002 and January 2018 in the CC-S (Figure 9). Although the CC-N population is less studied, there is evidence that vehicle strikes are a significant cause of mortalities in this population; at least six mountain lions have been

killed by vehicle strikes on Highway 17 in the Santa Cruz Mountains between 2008 and 2018 (Midpeninsula Regional Open Space 2017; Slade 2018) and news outlets reported at least three vehicle strikes killing mountain lions on the I-280 in San Mateo County between 2014 and 2016 (Wilmers 2014; CBS San Francisco 2015; Kamala 2016). Similarly, in 2018 at least two mountain lions were reported to have been killed by vehicle strikes in San Luis Obispo County in the CC-C (Tanner 2018). Clearly, vehicle strikes are an important cause of mortality for the Central Coast and Southern California mountain lion populations.

Figure 9. Locations of 18 mountain lion vehicle strikes in the Santa Monica Mountains and surrounding areas from July 2002 to January 2018. Source: NPS

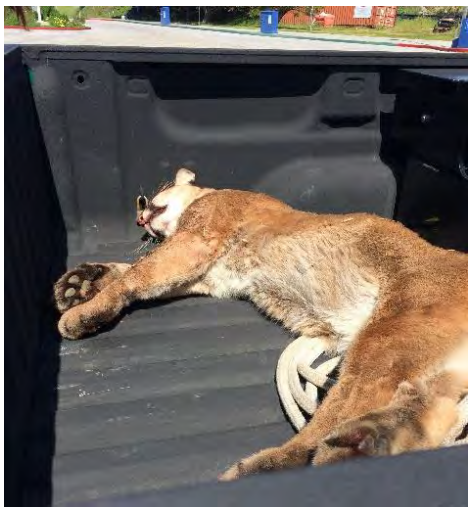
High adult mortality rates can have severe consequences, particularly for small populations with female-biased adult sex ratios and low effective population sizes (Beier and Barrett 1993; Benson et al. 2019). Vehicle strikes have been found to affect males and females equally, regardless of age, which can result in relatively high adult male mortalities (Vickers et al. 2015). Low male adult survival increases the risk of extinction, as it could result in occasional extinctions of breeding males and therefore reduced reproductivity (Benson et al. 2019), which has been previously observed in the SAM (Beier and Barrett 1993). In the Santa Monica Mountains, where adult survival is high, vehicle strikes (along with intraspecific strife) make it more difficult for subadults to successfully disperse, which limits breeding opportunities for mountain lions born in the Santa Monica Mountains (Riley et al. 2014; Benson et al. 2019). Freeways and vehicle strikes also limit the ability for immigrants to enter the Santa Monica Mountains and contribute to the population's gene pool (Riley et al. 2014; Benson et al. 2019). These patterns highlight the dire outlook for Central Coast and Southern California mountain lion populations due to lack of connectivity between populations and suitable habitat. The continued construction of roads and development and inaction to enhance connectivity threatens the survival of these struggling populations.

6.3 Depredation and Illegal Kills

Mountain lions killed on depredation permits (and one killed by vehicle strike) in San Diego County in 2015. Source: Vickers et al. (2017).

In 1990 California voters passed The California Wildlife Protection Act (Proposition 117), making the mountain lion a "specially protected species" and outlawing mountain lion sport-hunting in California. However, the law requires CDFW to issue depredation permits that allow people to "take" mountain lions when a mountain lion kills or injures domestic animals such as livestock or pets or damages property. The legal definition of "take" is to "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill" (Cal Fish & Game Code, *§86*), and the vast majority of permits to take in the three decades since the passage of Proposition 117 have authorized killing one or more mountain lions. The number of depredation permits issued and the number of reported kills has varied over time, and on average over 40% of permits result in reported kills. Since 1990 there has been an average of 97 reported depredation kills every year; however, these estimates are likely low due to underreporting and incomplete records (W. Vickers, *pers comm*). Depredation kills (along with vehicle strikes) account for the majority of mountain lion mortalities in the SAM and EPR (Vickers et al. 2015; Vickers et al. 2017). Although less is known about depredation kill impacts in the CC-N and CC-C, there is evidence that suggests depredation kills could be a significant source of mortality in these populations. In the Santa Cruz Mountains in the CC-N, depredation kills are the leading cause of death in collared mountain lions (Wang et al. 2017), and CDFW reported 34 depredation kills between 2010 and 2016 in the CC-N counties of Alameda, Contra Costa, San Mateo, Santa Clara, and Santa Cruz (see Appendix A[16]). Although population dynamics are even less studied in the CC-C, between 2010 and 2016 there were 46 reported depredation kills in the counties of Monterey, San Benito, San Luis Obispo, and Santa Barbara (See Appendix A*[Id.]*).

[16] These data were downloaded from the CDFW website; however, they no longer appear to be available online. These numbers have been shown to be low by a factor of two in some areas, likely due to incomplete reporting, and therefore should be considered absolute minimums (W. Vickers, *pers comm*).



An illegally killed mountain lion in San Mateo County. Photo: Tiffany Yap

Depredation kills result in more deaths in male mountain lions compared to female mountain lions. Statewide, of mountain lions killed for depredation in 2017, 68% were males (CDFW 2018), and from 1981 to 2013, there were 3.4 times more male than female mountain lions killed for depredating in the SAM and EPR (Vickers et al. 2015). The majority of lions reported killed for depredating were of subadult (1-2 years old) and adult mountain lions (>2 years old) (CDFW 2018), many of which were likely dispersers that may have not yet established home ranges. Dispersing lions often come up against roads and development as they search to establish home ranges (Beier 1995, Vickers 2015, Riley 2014). This suggests that even if individuals are able to navigate across roads and freeways without being struck by vehicles, they often come into conflict with humans, which threatens their survival. This was reflected in the EPR, when the only GPS collared immigrant to have crossed I-15 from 2001 to 2013 arrived from the SAM only to be killed on a depredation permit 25 days after his arrival for depredating a sheep (Vickers et al. 2015). Not only do lions killed for depredating diminish the total abundance of these populations, but because males are predominantly killed, the number of animals that are the primary gene dispersers are also greatly reduced, which further inhibits adequate genetic connectivity (Vickers et al. 2017).

Reported depredation kills do not include mountain lions that are illegally poached or killed, many of which likely go undocumented (Beier and Barrett 1993; Vickers et al. 2015). Illegal kills have been observed in the CC-S, SAM, and EPR (Beier and Barrett 1993; Riley et al. 2014; Vickers et al. 2015) as well as in the CC-N (Yap 2018 *pers observation*), and although 80 mountain lions were reported as being killed under depredation permits in 2017, 89 deaths were being investigated (CDFW 2018).

As mentioned in *Section 6.2 Vehicle Strikes*, high levels of mortalities among male breeders or potential male breeders (*i.e*., dispersers) can have severe impacts on small, isolated mountain lion populations with female-biased adult sex ratios and low effective population sizes (Beier and Barrett 1993; Benson et al. 2019). Low survival of breeding males increases extinction risk, as occasional breeding male extinctions can occur and therefore reduce reproductivity throughout the population (Beier and Barrett 1993; Benson et al. 2019). And low survival of subadults and adults may limit both dispersers and immigrants from successfully

breeding and increasing genetic diversity (Vickers et al. 2015; Benson et al. 2019). Thus, depredation and illegal kills in conjunction with lack of connectivity between populations and suitable habitat in the Central Coast and Southern California severely limit the potential for these populations to survive and reproduce. Continued development and lack of connectivity will likely push mountain lions into more conflicts with humans, which could increase depredation and retributory kills and further drive these populations towards extinction.

6.4 Intraspecific Strife

Intraspecific strife: a female mountain lion, P-7, was killed by her father, P-1. Photo: NPS

As detailed in *Section 5 Abundance and Population Trends*, intraspecific strife is the leading cause of mortality in the Santa Monica Mountains (Riley et al. 2014). Although intraspecific strife is a common source of mortality in mountain lion populations, (Beier and Barrett 1993; Logan and Sweanor 2001; Allen 2014), unusually high levels of intraspecific strife have been observed in this population (Riley et al. 2014). About 41% (9/22) of deaths in radio-collared mountain lions being tracked from 2002 to 2018 were from intraspecific strife,[17] with multiple cases of aggressive adult males killing their siblings, offspring (male and female), and previous mates (Riley et al. 2014). While males are likely to have larger home ranges to protect food resources and access to females, killing offspring or potential mates has no apparent evolutionary benefit, as it reduces chances of future reproduction (Riley et al. 2014). In addition, infanticide has been documented in the Santa Monica Mountains (Riley et al. 2014), perhaps to trigger the female to come into estrous. These high levels of intraspecific strife are likely due to limited space in the Santa Monica Mountains caused by dispersal barriers (Riley et al. 2014; Benson et al. 2019). As roads and development further encroach on Central Coast and Southern California mountain lion populations, intraspecific strife could become more common; this was

[17] The NPS provides puma profiles (last updated August-November 2018) of the marked animals (*i.e.*, tagged or radio-collared) they have been studying in the CC-S, which includes those studied in Riley et al. (2014). Some data presented in this section take these data into account. Accessed on 3 April 2019 at: https://www.nps.gov/samo/learn/nature/puma-profiles.htm.

documented in the SAM on two occasions (one GPS-collared, one previously GPS-collared) since the publication of Vickers et al. (2015) (W. Vickers *unpublished data*). Enhanced connectivity between populations and suitable habitat would facilitate dispersal, which would reduce and/or prevent high levels of intraspecific strife (Riley et al. 2014; Benson et al. 2019) and improve the survival and reproduction rates, especially for the most struggling populations.

6.5 Abandonment

Santa Monica Mountains mountain lion kittens P-57 and P-58 were abandoned by their mother, P-42, a first-time mother who left with male P-27 and never returned. Photo: NPS

Abandonment of kittens is fairly common in the Santa Monica Mountains and accounts for about 23% (5/22) of the known causes of death for marked/collared animals.[18] Although this likely occurs in other mountain lion populations, the causes of abandonment are unclear. There are various reasons why females might abandon their cubs. The cubs could be sick, the female may not be able to take care of them, or perhaps the female was initially protecting them from a mature male. Unfortunately, there is a lack of data regarding why and how often cubs get abandoned. Yet this is one of the main causes of death for mountain lions in the Santa Monica Mountains, which likely affects this already-small population.

Mountain lion cubs can also become orphaned if the mother is killed before they have dispersed. If they are too young to fend for themselves, they likely starve to death or are preyed upon by other predators. If the young are more mobile, they may come up against areas where they are more likely to encounter humans as they search for food. This was seen in November 2017, when a mother mountain lion was killed by a vehicle strike in the SAM and two of her cubs were found roaming near human establishments – one in a backyard and the other along a road (Veklerov 2018). Both were too young to survive on their own and were placed in the Oakland Zoo.

[18] Id.

6.6 Poisoning from Rodenticides and Other Environmental Toxicants

The famous mountain lion of Griffith Park, P-22, suffering from notoedric mange, a parasitic skin disease that has been linked with the ingestion of rodenticide poisoning (left) and mountain lion P-34 found dead on a trail due to rodenticide poisoning (right). Photos: NPS

Although mountain lions are not the primary target of environmental toxicants, such as rodenticides and other pesticides and herbicides, secondary poisoning has been documented in many non-target animals, especially predators (e.g., coyotes (Riley et al. 2003), bobcats (Riley et al. 2007; Serieys et al. 2015), San Joaquin kit fox (McMillin et al. 2008), California fishers (Gabriel et al. 2012), raptors (Lima and Salmon 2010), and many more). Data regarding pesticide poisoning in mountain lions are limited; however, there is evidence that these big cats are likely vulnerable to similar negative impacts that other predators experience, including direct death, weakened immune systems, and vulnerability to predators or conspecifics (Riley et al. 2003; Riley et al. 2007; Serieys et al. 2015; Rudd et al. 2019).

While poisoning can sometimes lead to direct death, rodenticide exposure has also been associated with notoedric mange, a parasitic skin disease that has led to high levels of mortalities, population declines, and even local extirpations in Southern California bobcats (Riley et al. 2007; Serieys et al. 2015). Although the link between rodenticide poisoning and mange is not as clear in mountain lions, since 2002 five mountain lions in the CC-S have been found suffering from mange, and researchers suspect that rodenticide poisoning may have played a role (Reyes-Velarde 2019a). In addition, of four dead mountain lions in the Santa Monica Mountains that were found to have rodenticides in their systems, two died from poisoning and two died from intraspecific strife, and it is possible that indirect effects of poisoning may have prevented the mountain lions from escaping conflict or fighting back (Riley et al. 2007). And rodenticide poisoning is suspected to be the cause of death in mountain lion P-47, who was recently found dead in Santa Monica Mountains (Reyes-Velarde 2019b), and CC-N mountain lion 36m, who was found dead in the Santa Cruz Mountains in 2015 (Wilmers 2015).

The Department of Pesticide Regulation (DPR) analyzed data provided by CDFW and found that 92% (59/64) of tested mountain lions from throughout the state had detectable levels of anticoagulant rodenticides, which indicates alarmingly high exposure rates (DPR 2018). This has been found to be true in the CC-S as well, where researchers have found that 94% (17/18) of mountain lions tested had traces of rodenticides in their systems (Reyes-Velarde 2019a).

Rodenticides have been implicated in mountain lion mortalities in the CC-S, and in the SAM anticoagulant rodenticide residues were detected in the livers of 100% of deceased animals tested, with up to five different compounds being detected in some animals (Riley et al. 2007; Riley et al. 2014; W. Vickers, *pers comm*). And a study conducted by CDFW and the Integral Ecology Research Center (IERC) has found that mountain lions are being exposed to dangerously high levels of illegal pesticides, such as carbofuran, being used on illegal marijuana grow sites, which can also bioaccumulate and cause health issues (Rudd et al. 2019). Furthermore, it is possible that herbicide exposure from deer could be detrimental to mountain lions as well. Although poisoning from environmental toxicants may not constitute a large proportion of direct deaths (that we are aware of), it is possible that high exposure levels influence other causes of mortalities. Any additional mortalities in the small, isolated Central Coast and Southern California populations suffering from other anthropogenic pressures could impact the short- and long-term survival of these mountain lions.

6.7 Wildfires

After the Woolsey Fire, the body of mountain lion P-64, known to use culverts to cross the Hwy-101 and SR-118 freeways a total of 41 times, was found dead with severely burned paws. Photos: NPS

Although fire is a natural disturbance in California ecosystems, sprawl development with low/intermediate densities extending into habitats that are prone to fire have led to more frequent wildfires that burn larger areas (Syphard et al. 2007; Syphard et al. 2009). Most wildfires in California are caused by human ignitions, like power lines, arson, improperly disposed cigarette butts, debris burning, fireworks, campfires, or sparks from cars or equipment (Keeley and Fotheringham 2003; Syphard et al. 2007; Syphard et al. 2012; Bistinas et al. 2013; Balch et al. 2017; Radeloff et al. 2018; Syphard et al. 2019). In fact, human-caused fires account for 95-97% of all fires in California's Mediterranean habitats (Syphard et al. 2007, Balch et al. 2017). In addition, climate change is leading to hotter, drier conditions that make fires more likely to burn. At least 29 fires throughout California in the last two years were caused by electric power and distribution lines, and transmission lines are suspected to be the cause of last year's Camp Fire and Woolsey Fire (Atkinson 2018; Chandler 2019).

Increased frequency of wildfires poses a threat to the survival of Central Coast and Southern California mountain lions. Although mountain lions are highly mobile and generally able to move away from wildfires, in severe weather conditions wind-driven fires can spread quickly – they can cover 10,000 hectares in one to two days, as embers are blown ahead of the

fires and towards adjacent fuels (*e.g*., flammable vegetation, structures) (Syphard et al. 2011). If their movement is constrained by roads and development and they are unable to access escape routes, then their chances of surviving wildfires are greatly reduced. Vickers et al. (2015) documented one death of a collared mountain lion in the SAM and one in the EPR due to human-caused wildfires, and the deaths of two collared mountain lions in the CC-S in 2018 have been attributed to the Woolsey Fire.[19] Environmentally stochastic events (*e.g*., wildfires, flooding) could destabilize small mountain lion populations and make them vulnerable to extinction (Benson et al. 2016a; Benson et al. 2019). In addition, increased frequency of fire ignitions can cause shifts in natural fire regimes, which can lead to large-scale landscape changes, such as vegetation-type conversion or habitat fragmentation, which can impact wide-ranging species like the mountain lion (Jennings 2018).

Increasing landscape connectivity (*e.g*., by designing corridors, removing barriers, and preserving habitats that are close to each other) is important for resilience to environmentally stochastic events and climate change adaptation (Heller and Zavaleta 2009). Enhanced connectivity that incorporates corridor redundancy (*i.e*. the availability of alternative pathways for movement) would allow for improved functional connectivity and resilience. Compared to a single pathway, multiple connections between habitat patches increase the probability of movement across landscapes by a wider variety of species, and they provide more habitat for low-mobility species while still allowing for their dispersal (Mcrae et al., 2012; Olson & Burnett, 2008; Pinto & Keitt, 2008). In addition, corridor redundancy provides resilience to uncertainty, impacts of climate change, and extreme events, including wildfires, by providing alternate escape routes or refugia for animals seeking safety (Cushman et al., 2013; Mcrae et al., 2008; Mcrae et al., 2012; Olson & Burnett, 2008; Pinto & Keitt, 2008).

6.8 Climate Change

A strong, international scientific consensus has established that human-caused climate change is causing widespread harms to human society and natural systems, and climate change threats are becoming increasingly dangerous. In a 2018 *Special Report on Global Warming of 1.5°C* from the Intergovernmental Panel on Climate Change (IPCC), the leading international scientific body for the assessment of climate change describes the devastating harms that would occur at 2°C warming, highlighting the necessity of limiting warming to 1.5°C to avoid catastrophic impacts to people and life on Earth (IPCC 2018). In addition to warming, many other aspects of global climate are changing. Thousands of studies conducted by researchers around the world have documented changes in surface, atmospheric, and oceanic temperatures; melting glaciers; diminishing snow cover; shrinking sea ice; rising sea levels; ocean acidification; and increasing atmospheric water vapor (USGCRP, 2017).

Climate change is increasing stress on species and ecosystems, causing changes in distribution, phenology, physiology, vital rates, genetics, ecosystem structure and processes, and increasing species extinction risk (Warren et al., 2011). A 2016 analysis found that climate-related local extinctions are already widespread and have occurred in hundreds of species, including almost half of the 976 species surveyed (Wiens 2016). A separate study estimated that nearly half of terrestrial non-flying threatened mammals and nearly one-quarter of threatened

[19] Id.

birds may have already been negatively impacted by climate change in at least part of their distribution (Pacifici et al. 2017). A 2016 meta-analysis reported that climate change is already impacting 82% of key ecological processes that form the foundation of healthy ecosystems and on which humans depend for basic needs (Scheffers et al. 2016). Genes are changing, species' physiology and physical features such as body size are changing, species are moving to try to keep pace with suitable climate space, species are shifting their timing of breeding and migration, and entire ecosystems are under stress (Cahill et al., 2012; Chen et al., 2011; Maclean & Wilson, 2011; Parmesan, 2006; Parmesan & Yohe, 2003; Root et al., 2003; Warren et al., 2011).

Improving landscape connectivity is a key factor for climate change resilience and adaptation (Heller and Zavaleta 2009). Without functional connectivity that provides multiple pathways for mountain lion movement, isolated Central Coast and Southern California mountain lion populations and the prey they depend on may not be able to shift their ranges as available resources shift. Enhanced connectivity that provides redundant corridors for safe passage between suitable habitats would improve chances of survival and reproduction in the face of climate change by increasing the probability of movement across landscapes by a wider variety of species and providing alternate escape routes or refugia for animals seeking safety (Mcrae et al. 2008; Pinto and Keitt 2008; Mcrae et al. 2012; Cushman et al. 2013; Olson and Burnett 2013).

7 Degree and Immediacy of Threat

As demonstrated in the previous sections, Central Coast and Southern California mountain lions are at risk of extirpation under current conditions. Roads and development have fractured connectivity, which has led to the separation of at least six isolated, genetically distinct populations in the CC-N, CC-C, CC-S, SAM, SGSB, and EPR (Ernest et al. 2014; Riley et al. 2014; Vickers et al. 2015; Benson et al. 2016a; Benson et al. 2019). Due to extreme isolation and high levels of human-caused mortalities, the SAM and CC-S mountain lions have low genetic diversity, low effective population sizes, and high levels of inbreeding (Ernest et al. 2014; Riley et al. 2014; Vickers et al. 2015; Benson et al. 2016a; Benson et al. 2019). Benson et al. (2019) predicted high losses of heterozygosity in the SAM and Santa Monica Mountains populations, which suggests that inbreeding depression is imminent. If inbreeding depression occurs, the SAM and Santa Monica Mountains/CC-S populations will likely go extinct within 50 years, with median times to extinction of 11.7 years and 15.1 years, respectively (Benson et al. 2019). With similarly low genetic diversity and effective population size, the SGSB and CC-N populations likely have a similar fate. And although the CC-C and EPR populations appear to be slightly healthier with more genetic diversity and a higher effective population size, these populations have effective population sizes that are still well below the most recent recommended threshold to prevent inbreeding depression in the short-term (Frankham et al. 2014; Gustafson et al. 2018); continued development in these areas could propel these populations towards extinction more quickly. Clearly, Central Coast and Southern California mountain lion populations are succumbing to anthropogenic pressures, and without immediate action to restore and enhance connectivity between the populations and suitable habitat, they will be lost, potentially within our lifetimes.

Immediate action is critical for the long-term persistence of Central Coast and Southern California mountain lions and the health of Central Coast and Southern California ecosystems. Connectivity between the populations and suitable habitat must be restored and enhanced to facilitate movement and gene flow while reducing human-caused mortalities. Anthropogenic pressures, especially vehicle strikes and depredation kills, should be minimized to help the recovery of these populations. Although translocation of outbred animals has been shown to be effective to increase genetic diversity (Johnson et al. 2010), this would only be a short-term, unsustainable solution given the current level of isolation of these populations (Ernest et al. 2014; Riley et al. 2014; Vickers et al. 2015; Benson et al. 2016a; Benson et al. 2019). Strategically-placed road/barrier crossing infrastructure that allows for dispersal and gene flow and reduces mortalities would be a more comprehensive, long-term solution to save these populations in perpetuity. And the preservation of intact linkages, especially the Tehachapi and Sierra Pelona Mountains, is essential to maintain statewide genetic connectivity. Immediate regulatory action under the CESA is needed to enhance connectivity among Central Coast and Southern California mountain lion populations and suitable habitat to ensure the conservation of these iconic big cats.

8 Inadequacy of Existing Regulatory Mechanisms

8.1 State Regulatory Mechanisms

Proposition 117

The California Wildlife Protection Act of 1990 (Proposition 117) declared that the mountain lion is a "specially protected mammal under the laws of this state." (Cal. Fish & Game Code § 4800(a).) Proposition 117 acknowledged that mountain lion habitat in the Santa Monica Mountains, Santa Ana Mountains, Santa Susana Mountains, and Simi Hills is disappearing rapidly and that "[s]mall and often isolated wildlife populations are forced to depend upon these shrinking habitat areas within the heavily urbanizing areas of this state." (Cal. Fish & Game Code § 2780(d).) Proposition 117 further found that "[c]orridors of natural habitat must be preserved to maintain the genetic integrity of California's wildlife." (*Id*.)

In order to preserve mountain lion populations in California, Proposition 117 mandated that mountain lions are not to be considered a "game mammal," such that hunting is generally prohibited. (Cal. Fish & Game Code § 3950.1(a).) Subject to certain exceptions, Proposition 117 makes it unlawful to take, injure, possess, transport, import, or sell a mountain lion. (Cal. Fish & Game Code § 4800(b).) Nonetheless, a mountain lion may still be removed or killed if it is "perceived to be an imminent threat to public health or safety" or is perceived by CDFW to be "an imminent threat to the survival of any threatened, endangered, candidate, or fully protected sheep species." (Cal. Fish & Game Code § 4801.) Mountain lions that have not been designated an "imminent threat to public health or safety" may still be removed via nonlethal means. (Cal. Fish & Game Code § 4801.5(a).)

A person whose livestock or other property has been damaged or destroyed by a mountain lion may request a permit to "take" the mountain lion. (Cal. Fish & Game Code § 4802.) CDFW is required to immediately take action to confirm that there has been a

depredation. (Cal. Fish & Game Code § 4803.) If CDFW is satisfied that there has been a depredation, CDFW "shall promptly issue a permit to take the depredating mountain lion." (*Id*.) There is no limit to the number of depredation permits a property owner can request from CDFW. In addition, mountain lions that are encountered while pursuing or inflicting injury on livestock or domestic animals may be taken immediately without the need for a permit. (Cal. Fish & Game Code § 4807.)

While Proposition 117 prohibits all hunting of mountain lions as well as the purposeful killing of mountain lions in most circumstances, it does not contain provisions to ensure that connectivity between core habitats for the Southern California or Central Coast mountain lions will be protected. As discussed above in *Section 6.0 Factors Affecting the Ability to Survive and Reproduce*, the primary threat to Southern California and Central Coast mountain lions is not hunting—it is habitat fragmentation and the lack of crossing infrastructure, which has led to major declines in genetic diversity, high levels of inbreeding, and high levels of human-caused mortalities via vehicle strikes, depredation kills, and intraspecific strife due to limited space and the inability for young mountain lions to disperse.

8.1.1 CDFW Departmental Bulletins

CDFW has issued "Departmental Bulletins" relating to mountain lions. The most recent bulletin was issued in December 2017 and applied specifically to the Santa Monica Mountains and SAM mountain lion populations (the "2017 Bulletin") (CDFW 2017).[20] The 2017 Bulletin acknowledged (1) the lack of genetic diversity in the Santa Monica Mountains and SAM mountain lion populations and (2) that human population growth and anthropogenic barriers are restricting connectivity with other mountain lion populations. In order to reduce unnecessary killings of mountain lions in the Santa Monica Mountains and SAM populations, the 2017 Bulletin provides that any person reporting a depredation (a "reporting party") may be issued a first permit to employ non-lethal measures to deter mountain lions from further depredation, and a second permit to "haze" a depredating mountain lion. In the first instance, the reporting party would institute economically feasible measures designed to reduce the potential for attracting mountain lions such as removing the carcasses of depredated animals, installing or repairing and consistently using enclosures to exclude mountain lions, or employing guardian animals in the immediate vicinity of livestock or other domestic animals. The 2017 Bulletin provides that CDFW would not be required to issue a lethal depredation permit until (1) a third depredation event has occurred, and (2) CDFW has confirmed that the reporting party has already implemented all reasonable preventative measures.

In January of 2018, CDFW adopted the 2017 Bulletin's new depredation permit policy. Although this provides some additional protections and will likely reduce lethal take of mountain lions in the Santa Monica Mountains and the SAM, researchers have documented instances wherein domestic animal owners killed mountain lions in these areas without complying with CDFW instructions under the new policy (W. Vickers, *pers comm*). The 2017 Bulletin does not apply to other vulnerable populations, like the SGSB, EPR, CC-N, and CC-C mountain lions. In

[20] California Department of Fish and Wildlife, *Human/Wildlife Interactions in California: Mountain Lion Depredation, Public Safety, and Animal Welfare – Amendment to Department Bulletin 2013-02* (Dec. 15, 2017), available at https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=153021.

addition, the new policy is not designed to ensure protection of habitat or connectivity necessary for the continued survival of the Santa Monica Mountains and SAM mountain lion populations and is insufficient to ameliorate the anthropogenic mortalities related to potential extirpation.

8.1.2 California Environmental Quality Act

The California Environmental Quality Act ("CEQA") is California's landmark environmental law and establishes a state policy to prevent the "elimination of fish or wildlife species due to man's activities, ensure that fish and wildlife populations do not drop below self-perpetuating levels, and preserve for future generations representations of all plant and animal communities...." (Cal. Pub. Res. Code § 21001(c)). Towards this end, state and local agencies are required to analyze and disclose the impacts of any discretionary decision or activity. CEQA contains a substantive mandate that agencies should not approve projects as proposed if there are feasible alternatives or mitigation measures which would substantially lessen the significant environmental effects of such projects. (Cal. Pub. Res. Code § 21002.)

CEQA requires a "mandatory finding of significance" if a project may "substantially reduce the number or restrict the range of an endangered, rare or threatened species." (Cal. Code Regs., tit. 14, § 15065(a)(1).) CDFW has interpreted this provision to apply to species of special concern, which are species that are "experiencing, or formerly experienced, serious (noncyclical) population declines or range retractions (not reversed) that, if continued or resumed, could qualify it for State threatened or endangered status."[21] CDFW further provides that species of special concern "should be considered during the environmental review process." (*Id.*; Cal. Code Regs., tit. 14, § 15380.) Thus, a potentially substantial impact on a species of special concern, threatened species, or endangered species could be construed as "per se" significant under CEQA. (*Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova* (2007) 40 Cal.4th 412, 449.) And under CEQA, when an effect is "significant," the lead agency approving the project must make a finding that changes or alterations have been incorporated into the project to avoid or mitigate its significant impacts, or that such changes are within the responsibility of another agency, or that mitigation is infeasible. (Cal. Pub. Res. Code § 21081(a).) These provisions therefore provide some protections to species that are listed as species of special concern, threatened, or endangered.

However, Southern California and Central Coast mountain lions are not listed as a species of special concern or as threatened or endangered, such that a project that has the potential to significantly impact one of these populations would not necessarily qualify as a "significant effect" under a lead agency's interpretation of CEQA. In such case, CEQA's substantive mandate to adopt all feasible alternatives or mitigation measures might not be triggered.

CEQA also requires a "mandatory finding of significance" if a project may "substantially reduce the habitat of a fish or wildlife species; cause a fish or wildlife population to drop below self-sustaining levels; threaten to eliminate a plant or animal community." (Cal. Code Regs., tit. 14, § 15065.) Moreover, CEQA's "Environmental Checklist" in Appendix G of the CEQA

[21] California Department of Fish and Wildlife, *Species of Special Concern* , available at https://www.wildlife.ca.gov/Conservation/SSC.

Guidelines characterizes a project's effects as "significant" if the project would "interfere substantially with the movement of any native [] wildlife species or with established native resident or migratory wildlife corridors...."

While these provisions might theoretically offer some protection for Southern California or Central Coast mountain lions, in practice they have not provided sufficient protection. Under CEQA, lead agencies have discretion to develop their own thresholds of significance. (*East Sacramento Partnerships for a Livable City v. City of Sacramento* (2016) 5 Cal.App.5th 281, 300; Cal. Code Regs., tit. 14, § 15064(d)). This allows local agencies—who are often under pressure from developers to approve projects—to make significance determinations that are inconsistent with independent scientific analysis, including CDFW's analysis. For instance, in December 2017, the City of Temecula approved a 200-acre mixed use project called the Altair Specific Plan that would allow development in the last remaining viable linkage for the SAM mountain lion population between the Santa Ana Mountains and Peninsular Ranges. The City determined that impacts to mountain lions were not significant despite strong disagreement by CDFW, USFWS, and independent mountain lion experts.[22] CDFW warned the City of Temecula that the SAM population has "extremely low genetic diversity which is attributed to low gene flow between the small Santa Ana Mountains population and the larger population in the Peninsular Ranges" and that development is contributing to this genetic decay. (*Id*.) CDFW concluded that "increased human activity associated with the proposed Civic Site at this sensitive location would [] be detrimental to facilitating the movement of mountain lions across Interstate Highway 15 (I-15) to the Peninsular Range." (*Id*.)

Even when a lead agency acknowledges that an effect is "significant," CEQA allows a lead agency to adopt a "statement of overriding considerations" and approve a project if the agency finds that other factors outweigh the environmental costs of the project or that further mitigation is infeasible. (Cal. Code Regs., tit. 14, § 15093(b); Cal. Pub. Res. Code § 21081.) This means that even if a project may have a significant effect on a "wildlife population" like the CC-S, SAM, SGSB, or EPR mountain lions, an agency could interpret CEQA as still allowing approval of the project. CEQA in practice is therefore inadequate to protect the Southern California and Central Coast mountain lions.

Finally, as noted above, the lack of adequate wildlife connectivity and wildlife crossings is the primary factor driving Southern California and Central Coast mountain lions closer to extinction. Yet, agencies have not interpreted CEQA (or the National Environmental Policy Act, discussed further below) as including a clear legal mechanism for mitigation for impacts on wildlife connectivity. For example, in the Final Environmental Impact Report/Final Environmental Impact Statement for the Northwest 138 Corridor Improvement Project (the "Northwest 138 EIR"), Caltrans and the Los Angeles County Metropolitan Transportation Authority wrote: "The proposed project has the potential to directly or indirectly impact wildlife movement throughout the project limits. However, with the inclusion of the proposed avoidance and minimization measures, impact levels area expected to be relatively low. Exact acres of impacts to wildlife corridors are unable to be quantified, and currently there is no real

[22] City of Temecula, *Altair Specific Plan Final Environmental Impact Report* (Oct. 2017), available at https://temeculaca.gov/DocumentCenter/View/4513/Altair-Specific-Plan-Final-Environmental-Impact-Report-FEIR.

mechanism for compensatory mitigation for these types of impacts."[23] The Northwest 138 EIR also contained no analysis of the highway's impacts on mountain lions, given that they are not presently listed as threatened or endangered.

Indeed, CDFW has urged lead agencies to consider wildlife connectivity in CEQA planning documents, without success. For instance, the Los Angeles County General Plan Draft EIR concluded that the buildout of the General Plan "will impact regional wildlife linkages" and have a "significant adverse effect on wildlife movement."[24] The Draft EIR concluded that policies proposed in the General Plan "do not provide for mitigation for loss of wildlife movement opportunities. If development impacts regional wildlife linkages and impedes wildlife movement, connectivity will be lost on a regional scale in these vital landscape corridors and linkages. Thus impacts to wildlife movement remain significant at the General Plan level." (*Id*.) In commenting on the Draft EIR, CDFW specifically objected to this conclusion:

> The Department does not concur with the conclusion in the DPEIR that unavoidable loss of wildlife movement opportunities or nursery sites within or outside of an SEA does not warrant mitigation. Without mitigation, the Project and subsequent projects would result in direct and cumulative loss of biological diversity. Mitigation opportunities for wildlife corridors and nursery sites are best established during large scale planning efforts such as this General Plan. Wildlife corridor areas can be delineated and set aside in the General Plan for current and future conservation efforts. An assessment could be placed on development within the Project area to secure the acquisition of these critical linkages and sites, therefore reducing impacts to wildlife corridors and nursery sites and ensuring biological diversity.[25]

In responding to this comment, Los Angeles County refused to implement CDFW's recommendations, claiming "it cannot be assumed that wildlife corridor areas for future conservation that can be set aside because those properties may not become publicly owned." (*Id*.) Los Angeles County's responses to CDFW's recommendations underscore that lead agencies have not interpreted CEQA to include a clear legal mechanism for mitigation for impacts on wildlife connectivity, even though such connectivity is critical to the survival of Southern California and Central Coast mountain lions.

8.1.3 Significant Natural Areas Program

The Significant Natural Areas Program ("SNAP") requires CDFW to develop and maintain a spatial data system that identifies those areas in the state that are most essential for maintaining habitat connectivity, including wildlife corridors and habitat linkages. (Cal. Fish & Game Code § 1932(b).) SNAP also requires CDFW to consult with other government agencies and stakeholders to identify natural areas deemed to be most significant. (Cal. Fish & Game

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[23] State of California Department of Transportation, *Northwest State Route 138 Corridor Improvement Project Final Environmental Impact Report / Environmental Impact State and Section 4(f) Evaluation* (June 2017), available at https://www.metro.net/projects/nw138/nw138-FEIR-FEIS/.

[24] County of Los Angeles, *Los Angeles County General Plan Update Draft Environmental Impact Report* (June 2014), available at http://planning.lacounty.gov/assets/upl/project/gp_2035_deir.pdf.

[25] County of Los Angeles, *Los Angeles County General Plan Update Final Environmental Impact Report* (March 2015), available at http://planning.lacounty.gov/assets/upl/project/gp_2035_lac-gpu-final-eir-final.pdf.

Code § 1932(f).) SNAP further requires CDFW to seek maintenance and perpetuation of the state's most significant natural areas for present and future generations in the most feasible manner. (Cal. Fish & Game Code § 1932(g).)

However, SNAP does not require or authorize any particular land use action or decision. (Cal. Fish & Game Code § 1932.5.) Likewise, SNAP does not change or prevent the change of use of any area identified pursuant to the program. (Cal. Fish & Game Code § 1933.) It therefore does not *require* any particular natural areas to be conserved. Because of this, it is insufficient to protection wildlife connectivity essential to the survival of Southern California and Central Coast mountain lions.

8.1.4 Natural Community Conservation Planning Act

The Natural Community Conservation Planning Act is a voluntary conservation planning mechanism for proposed development projects within a planning area to avoid or minimize impacts to wildlife. (Cal. Fish & Game Code § 2801(f).) The NCCP Act is designed to promote coordination among agencies and landowners to conserve unfragmented habitat areas and multihabitat management. (Cal. Fish & Game Code § 2801(d).)[26]

There are no Natural Community Conservation Plans ("NCCPs") that cover the Santa Monica Mountains or San Gabriel Mountains. There are a few NCCPs that cover portions of the Santa Ana Mountains and Eastern Peninsular Ranges, some of which also act as "habitat conservation plans" or "HCPs" pursuant to the Federal Endangered Species Act (16 U.S.C. § 1539). These include the County of Orange (Central Coastal) NCCP/HCP, the Orange County Transportation Authority NCCP/HCP, Western Riverside County Multiple Species HCP, San Diego Multiple Habitat Conservation Program, San Diego Multiple Species Conservation Program, and the San Diego North County Multiple Species Conservation Plan. There also is an NCCP that covers the Coachella Valley and portions of the San Bernardino Mountains called the Coachella Valley NCCP/HCP.

Of these NCCPs, only four "cover" portions of the Southern California mountain lion populations: (1) Western Riverside County Multiple Species HCP; (2) San Diego Multiple Habitat Conservation Program; (3) San Diego County Multiple Species Conservation Program; and (4) San Diego North County Multiple Species Conservation Plan.[27] Below is a discussion of each as they relate to mountain lions:

(1) The Western Riverside County Multiple Species HCP acknowledges that the SAM mountain lion population is at high risk of extirpation due to demographical instability unless there is a "movement connection between the Santa Ana Mountains

[26] The NCCP Act also is described on CDFW's website at https://www.wildlife.ca.gov/conservation/planning/NCCP.

[27] California Department of Fish and Wildlife, *Conservation Plans By Species*, available at https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=108719&inline. Both San Diego Gas & Electric and San Diego County Water Authority are permittees of HCPs/NCCPs covering mountain lions, but these only apply to activities undertaken by these entities.

and the Palomar Mountains."[28] However, mountain lions are considered to be "adequately conserved."[29] As such, the Western Riverside County Multiple Species HCP offers little protection for the SAM mountain lion population. While this HCP does identify linkages designed to ensure connectivity for mountain lions, the Western Riverside County Regional Conservation Authority has failed to enforce the HCP to protect such linkages when permittees such as the City of Temecula approve development that would severely constrict or impair such linkages.

(2) The San Diego Multiple Habitat Conservation Program is an NCCP and HCP that purportedly covers mountain lions, but the program readily concedes that mountain lions (as well as deer) "were not a major consideration in linkage design."[30] In addition, the EIR/EIS states that "[d]ue to the limited availability of habitat in the study area, implementation of the MHCP is not expected to substantially increase or decrease the population viability of the mountain lion."[31] The EIR/EIS likewise concludes there are no major populations or critical locations for the mountain lion within the plan area, and concludes it is "adequately conserved" under the plan. (*Id*.)

(3) The San Diego Multiple Species Conservation Program is an NCCP and HCP that covers 900 square miles in the southwestern portion of the San Diego. The Program lists mountain lions as "conserved" and states that mountain lions "will be covered by the MSCP because 81% of the core areas (105,000± acres) that support its habitat will be conserved."[32] While the Program generally notes that linkage areas were designed to accommodate "large animal movement," the Program does not identify any linkages designed for mountain lions or any specific measures designed to protect them. Likewise, while the Program states that "[s]pecific design criteria for linkages and road crossings/undercrossings are included in subarea plans," not all subarea plans are complete.

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[28] Western Riverside County Regional Conservation Authority, *Western Riverside County MSHCP Species Accounts*, available at http://wrcrca.conserveriverside.com/wrcrca/Permit_Docs/MSHCP_Docs/volume2/vol2-secb_Mammals.pdf.

[29] Western Riverside County Regional Conservation Authority, *Western Riverside County Multiple Species Habitat Conservation Plan*, available at http://wrcrca.conserveriverside.com/wrcrca/Permit_Docs/MSHCP_Docs/volume1/Vol1-sec2.pdf.

[30] San Diego Association of Governments, *San Diego Multiple Habitat Conservation Program Biological Monitoring and Management Plan (Volume III)* (Mar. 2003), available at https://www.sandag.org/programs/environment/habitat_preservation/mhcp_vol3.pdf.

[31] San Diego Association of Governments, *Final Environmental Impact Statement/Environmental Impact Report for Threatened and Endangered Species Due to Urban Growth within the Multiple Habitat Conservation Program Planning Area* (Mar. 2003), available at https://www.sandag.org/programs/environment/habitat_preservation/mhcp_eir_vol1.pdf.

[32] County of San Diego, *Final Multiple Species Conservation Program* (Aug. 1998), available at https://www.sandiegocounty.gov/content/dam/sdc/pds/mscp/docs/SCMSCP/FinalMSCPProgramPlan.pdf.

(4) The San Diego North County Multiple Species Conservation Plan is one of the "subarea" plans anticipated by San Diego Multiple Species Conservation Program. However, it has not been completed and is still "in development."[33]

(5) The Orange County Transportation Authority NCCP/HCP ("OCTA Plan") lists the mountain lion as a covered species for purposes of the federal HCP, but not for purposes of the NCCP permit. The OCTA Plan acknowledges that despite protection from hunting, annual survival for radio-collared lions is "surprisingly low" at 55.8 percent and that vehicle collisions and depredation permits are primary sources of mortality. The OCTA Plan states that targeted investment in habitat protection is "especially urgent to maintain viability of the Santa Ana Mountains populations."[34] The OCTA Plan does contain four "Species Goals" for mountain lions, including (1) acquiring 1,013 acres of suitable habitat; (2) fencing realignment near the Highway 241 toll road; (3) funding of the North Coal Canyon Restoration Project; and (4) a "wildlife crossing policy" requiring pre-construction surveys to ensure existing crossings "maintain or improve functionality" if modified by new freeway projects. However, despite allowing the expansion of two highways in lion habitat (Projects G and J), the OCTA Plan does not require the construction of any specific wildlife crossings. The OCTA Plan nonetheless claims that impacts on the mountain lion will be offset through these "Species Goals."

There are no NCCPs that cover the Central Coast. In addition, there are no NCCPs that cover portions of the Santa Cruz Mountains except the Santa Clara Valley Habitat Plan. However, this Plan does not cover mountain lions.

8.2 Federal Regulatory Mechanisms

8.2.1 National Environmental Policy Act

The National Environmental Policy Act ("NEPA") is the nation's charter for protection of the environment. (40 C.F.R. § 1500.1(a).) NEPA is designed to ensure that environmental information is available to the public *before* decisions are made or actions taken and to help public officials make decisions based on an understanding of the environmental consequences. (40 C.F.R. § 1500.1(b)-(c).) Federal agencies must prepare an environmental impact statement ("EIS") if it is known that an action will significantly affect the environment, or an environmental assessment ("EA") if the extent of effects are unknown. (42 U.S.C§ 4332; 40 C.F.R. §§ 1502.3 & 1508.9.) NEPA further requires federal agencies to analyze reasonable alternatives to the proposed project. (40 C.F.R. § 1502.14(a)-(c).) NEPA requires the federal agency to consider the degree of adverse effect on a species or its critical habitat designated pursuant to the Federal Endangered Species Act. (*Conservation Cong. v. United States Forest Serv*. (E.D.Cal. 2017) 235 F.Supp.3d 1189, 1207.)

[33] County of San Diego, *Multiple Species Conservation Program*, available at https://www.sandiegocounty.gov/pds/mscp/.
[34] Orange County Transportation Authority, *Natural Community Conservation Plan/Habitat Conservation Plan* (Nov. 2016), available at https://www.octa.net/pdf/NCCP%20HCP%20FINAL.pdf.

However, agencies have not interpreted NEPA as requiring analysis of impacts to populations that are not currently listed as threatened or endangered, such as the Southern California or Central Coast mountain lions. For instance, Caltrans prepared an Initial Study with Proposed Mitigated Negative Declaration/Environmental Assessment for the State Route 118 Widening Project (the "State Route 118 EA") in October 2017 pursuant to NEPA and CEQA. The State Route 118 EA contains no analysis of whether adding more traffic lanes to State Route 118 will impact mountain lions or degrade wildlife connectivity even though multiple mountain lions have died recently attempting to cross State Route 118.[35]

NEPA also is insufficient to protect Southern California and Central Coast mountain lions because courts have interpreted NEPA as primarily a "procedural" statute. While NEPA does require federal agencies to consider detailed information regarding a project's environmental effects, "NEPA itself does not mandate particular results." (*Winter v. NRDC, Inc.* (2008) 555 U.S. 7, 23.)

8.3 Regional and Local Plans and Policies

8.3.1 Santa Monica Mountains National Recreation Area General Management Plan

The Santa Monica Mountains National Recreation Area General Management Plan ("GMP") was prepared pursuant to NEPA and provides a framework for the management of the Santa Monica Mountains National Recreation Area ("SMMNRA"), which is administered by the National Park Service, California State Parks, and the Santa Monica Mountains Conservancy. The GMP recognizes that the Santa Monica Mountains mountain lion population's ability to survive in the face of large-scale habitat fragmentation and destruction is uncertain.[36] (GMP at 154.) The GMP states that "it is likely that their persistence [] would depend upon their capability of dispersing to and from other habitat areas beyond the Santa Monica Mountains." (GMP at 154; see also GMP at 157.) The GMP identifies the "greatest threat" to natural resource preservation in the SMMNRA as "loss of habitat connectivity from increased development and urban encroachment." (*Id*. at 157.) The GMP concedes that "the situation is especially serious for mountain lions" and lists mountain lions as a "park species of concern." (*Id*. at 157 & 161.) The GMP agrees that improvements to facilitate wildlife movement across freeways or through developments may be necessary, but does not propose or require any specific actions to improve wildlife movement across freeways or through development.

The preferred alternative in the GMP provides for enhancing connectivity of undisturbed habitats in the SMMNRA by creating large expanses of open space. (*Id*. at 292.) In addition, the Las Virgenes Canyon and Liberty Canyon areas are included within the SMMNRA boundary to help provide wildlife connectivity for mountain lions and other large species. (*Id*. at 293.) Even though the GMP recognizes the threats facing the Santa Monica Mountains mountain lion

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[35] National Parks Traveler, *Another Mountain Lion Killed Near Santa Monica Mountains National Recreation Area* (Jan. 27, 2017), available at https://www.nationalparkstraveler.org/2017/01/another-mountain-lion-killed-near-santa-monica-mountains-national-recreation-area.

[36] National Park Service, U.S. Department of Interior, *Santa Monica Mountains National Recreation Area General Management Plan Environmental Impact Statement* (July 2002), available at https://www.nps.gov/samo/learn/management/loader.cfm?csModule=security/getfile&PageID=383979.

population and takes steps to protect this population, the GMP does not apply to lands outside of the SMMNRA and thus is insufficient to address the regional connectivity issues facing the population. Nor does the GMP apply to roads and highways under Caltrans' jurisdiction.

8.3.2 Ventura County Wildlife Connectivity Ordinance

The Ventura County Board of Supervisors adopted an ordinance on March 12, 2019 (the "Connectivity Ordinance") to help facilitate wildlife connectivity and minimize habitat fragmentation for mountain lions, mule deer, California gnatcatchers, bobcats, least bell's vireos, California red-legged frogs, and other species. The Connectivity Ordinance establishes overlay zones called "habitat connectivity and wildlife corridors" ("HCWCs") and "critical wildlife passage areas" ("CWPAs") in which development standards and permitting requirements apply. Development standards include 200-foot setbacks from surface water features such as streams and wetlands, limits on certain wildlife impermeable fencing, encouraging compact siting of development, and prohibiting non-commercial planting of invasive plants. Two of the linkages targeted in the Connectivity Ordinance are the Santa Monica Mountains – Sierra Madre Mountains connection and the Sierra Madre Mountains – Castaic Connection, which connect wildlife habitat in the Santa Monica Mountains, Santa Susana Mountains, Simi Hills, and Los Padres National Forest.

While the Connectivity Ordinance should help allow wildlife to move more easily through private lands between core habitat areas, it would do little to ensure connectivity across major roads and highways because Ventura County does not have jurisdiction over these areas. The ordinance would, however, establish 200-foot setbacks from the exit and entry points of 25 existing road crossings in order to facilitate wildlife movement through the crossings. Caltrans and its road maintenance and improvement activities are not regulated by the Connectivity Ordinance. The Connectivity Ordinance is therefore a step in the right direction but insufficient on its own to address the threats facing the CC-S mountain lion population.

8.3.3 Los Angeles County Significant Ecological Areas Program

Los Angeles County is currently in the process of updating the Significant Ecological Areas ("SEAs") Ordinance. The draft ordinance is intended to protect biodiversity in SEAs from incompatible development and ensure that projects reduce habitat fragmentation and edge effects by providing technical review of impacts and requiring mitigation.[37] Like the Ventura County ordinance, the SEAs designations can lead to compact development and allow wildlife to more easily move across private lands between core habitat areas. However, the SEA ordinance is not specifically designed to protect mountain lions and would not regulate Caltrans and its road maintenance and expansion activities.

[37] Los Angeles County Department of Regional Planning, *Significant Ecological Areas Ordinance Update, Public Hearing Draft* (Feb. 14, 2019), available at http://planning.lacounty.gov/site/sea/wp-content/uploads/2019/02/EX-C-SEA-Ordinance-Public-hearing-Draft-2-14-2019.pdf

8.4 Future Development Will Further Threaten the Survival of Southern California Mountain Lions

Continued development in Southern California is expected to further impair connectivity between core habitat areas, leading to further decreases in genetic diversity for Southern California mountain lions. In the environmental review for Southern California national forest land management plans, the U.S. Forest Service found that impaired connectivity poses a serious threat to Southern California mountain lions: the "greatest concern for the long-term health of mountain lion populations on the national forests of southern California is loss of landscape connectivity between mountain ranges and large blocks of open space on private land."[38] The review warned that private land development in Southern California is "steadily reducing the habitat linkages that wildlife species need to connect large blocks of national forest land with other public and private natural spaces and habitat reserves." The review observed that the "widening of the existing highway system and new highways" are a threat to mountain lions because they create barriers to movement. The review concluded that "[w]ithout the national forests and linkages between the mountain ranges and other large habitat preserves*, there is not much long term potential for mountain lions in southern California.*" The review noted that maintenance and restoration of corridors between large wildlands is essential to conserving mountain lions in Southern California

As anticipated by the U.S. Forest Service's environmental review, private land development is currently being approved on linkage areas without sufficient mitigation for Southern California mountain lions or wildlife connectivity. For instance, the 1,000-acre Northlake Specific Plan ("Northlake") was approved by the Los Angeles County Board of Supervisors on April 2, 2019. The Santa Monica Mountains Conservancy ("SMMC") formally objected to the Board's approval of Northlake, noting that the development would degrade a known wildlife linkage between the Angeles National Forest and Los Padres National Forest.[39] CDFW raised similar concerns about the development because it would impair a linkage that is "highly suitable for regional wildlife movement and connectivity" for mountain lions and other species.[40] The Board of Supervisors approved Northlake notwithstanding the objections and concerns of SMMC and CDFW.

Likewise, the Los Angeles County Board of Supervisors approved the 12,000-acre Centennial Specific Plan ("Centennial") on April 30, 2019, despite SMMC warning the Board that Centennial "would sever the most optimal five-mile-wide habitat linkage across Highway 138 between I-5 and State Route 14."[41]

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[38] Forest Service, U.S. Department of Agriculture, *Final Environmental Impact Statement, Land Management Plans, Angeles National Forest Cleveland National Forest Los Padres National Forest San Bernardino National Forest* (Sept. 2005), available at https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5166889.pdf.
[39] Santa Monica Mountains Conservancy, *Draft Supplemental Environmental Impact Report Comments on Northlake Specific Plan Project,* May 22, 2017.
[40] California Department of Fish and Wildlife, *Draft Supplemental Environmental Impact Report Comments on Northlake Specific Plan*, June 12, 2017.
[41] Santa Monica Mountains Conservancy, *Centennial Project Draft Environmental Impact Report Comments County Project No. 02-232*, July 17, 2017.

In the SAM, key linkage and habitat areas remain unprotected and subject to potential or actual development. The Altair Specific Plan discussed in *Section 8 Inadequacy of Existing Regulatory Mechanisms* exemplifies this trend. Other lands in the Santa Ana-Palomar Mountain linkage have been subject to development proposals such as the Temecula Creek Inn (Vickers 2015). The Orange County Board of Supervisors also approved a 6,000-acre development in the Santa Ana Mountains in the "center of puma habitat" (Vickers 2015).[42]

Development in wildlands and linkages will intensify as Southern California's population increases. The Southern California Association of Governments ("SCAG") Program EIR estimates that between 2016 and 2040 the Southern California region will grow by 3.8 million residents and 1.5 million households.[43] The SCAG Program EIR concludes that transportation projects within the SCAG region such as "mixed flow lane projects" and "grade separation projects" may result in significant impacts on wildlife movement, including direct habitat removal and fragmentation that would disrupt corridor functionality. The SCAG Program EIR also acknowledges that "an increase in wildlife-roadway interactions as a result of the development of new transportation projects may increase wildlife injury and fatalities."

The SCAG Program EIR recognizes that "[b]arriers to wildlife movement exist throughout the SCAG region, including large areas of urban development and multilane freeways that cut off regional movement corridors for large migratory species such as mountain lions (*Puma concolor*)." SCAG Program EIR further notes that "wildlife crossings serve to alleviate these barriers and facilitate wildlife movement through the region" and references the planned Liberty Canyon Crossing. However, the Program EIR does not identify any other planned crossings or identify funding for the Liberty Canyon Crossing.

The SCAG Program EIR also confirms that only portions of the lands in the Santa Monica Mountains, SAM, SGSB, and EPR are designated as "open space and recreation" or "undevelopable and protected." Indeed, much of these lands are designated for single family residential or mixed residential. At this time, there are also "vast areas" in Southern California that are undeveloped but are not designated as open space or are otherwise protected, according to SCAG. In addition, agricultural lands are rapidly being converted to urban development throughout Southern California with an estimated 230,000 acres converted between 1996 and 2004 and up to 700,000 acres may be converted by 2030. In short, SCAG recognizes that wildlife connectivity will become even more impaired in the Southern California region due to anticipated growth, but SCAG does not offer any solutions to address the effects of this impaired connectivity on Southern California mountain lions.

Other studies confirm that much of the remaining mountain lion habitat in Southern California is on unprotected lands and at risk of development. According to Burdett et al. (2010), almost half of suitable mountain lion habitat in Southern California (since 1970) is on private lands, of which 35% will be developed by 2030, and other currently contiguous habitat will

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[42] See also Chris Boucly, "New community coming to South County," *The Orange County Register* (Mar. 24, 2012), available at https://www.ocregister.com/2012/03/24/new-community-coming-to-south-county/

[43] Southern California Association of Governments, *Draft Program Environmental Impact Report* (Dec. 2015), available at http://scagrtpscs.net/Documents/2016/peir/draft/2016dPEIR_Complete.pdf.

become fragmented. Hunter et al. (2003) similarly found that 30% of high suitability mountain lion habitat and 76% of medium suitability mountain lion habitat in Southern California is not protected from development. In addition, Zeller et al. (2017) found that only 35% of resource-use patches and 47% of corridors identified in their study area, which encompassed much of the SAM and EPR, were fully protected. Given the extreme isolation, low genetic diversity, and high adult mortality rates from vehicle strikes and depredation kills, increased efforts to protect the species and their habitat are warranted.

Within Riverside County, which covers a significant portion of the Santa Ana Mountains, population growth is expected to be especially high; the Riverside County General Plan predicts that the County's population and housing stock will increase to 3.6 million people and 1.3 million dwelling units by 2035, which constitutes a 65 percent increase.[44] Within San Bernardino County, which encompasses portions of the San Bernardino and San Gabriel Mountains, more than 630,000 people will be added to the County along with 230,000 homes.[45] As urban development overtakes mountain lion habitat and linkage areas throughout the region, conflict with mountain lions, and consequent killing of lions under depredation permits will likely increase. Similarly, use of anticoagulant rodenticides and other environmental toxicants in these areas will likely increase, leading to increased illness and fatalities to "non-target organisms" such as Southern California mountain lions.

Caltrans and local transportation agencies are expected to continue building and expanding roads and highways in Southern California to accommodate actual and anticipated vehicles and development. Caltrans' 2018 State Transportation Improvement Program ("STIP") lists many large-scale road and highway projects planned for Southern California.[46] These include converting SR-71 to a four- and six-lane freeway as well as adding more lanes to the I-15 Freeway adjacent to the SAM,[47] which already acts as a nearly impenetrable barrier to the SAM and EPR mountain lion populations. As noted in *Section 8 Inadequacy of Existing Regulatory Mechanisms*, Caltrans has certified an EIR/EIS to convert the existing two-lane SR-138 into a four or six-lane highway, which will create major barrier between the Tehachapi Mountains and Angeles National Forest. Caltrans also intends to widen SR-118, which will further impair connectivity between the Santa Monica Mountains and Santa Susana Mountains to the detriment of the Santa Monica Mountains mountain lions. There are numerous other road and highway projects planned for Southern California in the next few years.[48] These projects will be funded in part by SB 1, which will raise approximately $52 billion over 10 years.

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[44] County of Riverside, *Riverside County General Plan Environmental Impact Report No. 521* (March 2014), available at https://planning.rctlma.org/Portals/14/genplan/general_plan_2014/EnvironmentalImpactReport/03-0_ProjectDescription_2014-04-07.pdf.

[45] San Bernardino County, *Countywide Plan Growth Forecast*, available at http://countywideplan.com/wp-content/uploads/2018/08/CWP_OH_GrowthForecast_FINAL_20180809.pdf.

[46] California Department of Transportation, *2018 Report on STIP Balances County and Interregional Shares* (Aug. 1, 2018), available at http://www.catc.ca.gov/programs/stip/2018-stip/2018_ORANGE_BOOK.pdf.

[47] Riverside County Transportation Commission, *I-15 Express Lanes Project Southern Extension*, https://www.rctc.org/i15-express-southern-extension/

[48] Kurt Snibbe, "Here are the major highway improvement projects happening in Southern California through 2023," *Orange County Register* (Jan. 23, 2018), https://www.ocregister.com/2018/01/23/here-are-maps-and-a-list-of-the-major-highway-improvement-projects-in-southern-california/; Jeong Park, "2019 will be a busy year for big road construction projects in Orange County," *Orange County Register* (Dec. 31, 2018),

Along with this expansion in roads and highways will come an increase in automobile use: SCAG predicts that the number of vehicle miles travelled ("VMT") in the region is expected to increase 13.3 percent by 2040 (from 448 million VMT per day to 504 million VMT per day). This significant increase in automobile use will further impair connectivity and lead to more collisions between automobiles and lions.

8.5 Future Development Will Further Threaten the Survival of Central Coast Mountain Lions

Future development and highway expansion in the San Francisco Bay Area and Central Coast is anticipated to further fragment habitat for Central Coast mountain lion populations and will increase threats to their survival.

The Association of Bay Area Governments' Plan Bay Area projects that the population of the San Francisco Bay Area is expected to increase from 7.2 million to 9.3 million by 2040—a 30 percent increase.[49] This includes a 26 percent increase in San Mateo County and a 36 percent increase in Santa Clara County, both of which encompass significant portions of the Santa Cruz Mountains. The Plan Bay Area also envisions a 25 percent increase in housing units in San Mateo County, and a 31 percent increase in Santa Clara County.

The Greenbelt Alliance's "At Risk" Report ("Greenbelt Report") estimates that 22,700 acres in San Mateo County are at medium or high risk for development, significant portions of which are in the Santa Cruz Mountains.[50] The Greenbelt Report shows that only 113,000 acres of the Santa Cruz Mountains are permanently protected and warns that San Mateo County has planned to develop housing in remote areas on the eastern slope of the Santa Cruz Mountains. The Greenbelt Report estimates that Santa Clara County has 54,100 acres at high or medium risk of development, significant portions of which are in the Santa Cruz Mountains and eastern foothills. The Greenbelt Report further shows that while large swaths of the eastern Santa Cruz Mountains are currently at "low risk" for development, only fragmented portions enjoy permanent protection.

Similarly, the EIR for the Plan Bay Area 2040 notes that land use growth footprints overlap with approximately 1,040 acres of "Essential Connectivity Areas" or "ECAs."[51] The EIR claims these growth footprints are in already urbanized corridors that are degraded so that their function as linkages is limited. The EIR acknowledges that development projects may directly encroach on wildlife corridors, but does not provide any plan to address the effects of

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https://www.ocregister.com/2018/12/31/2019-will-be-a-busy-year-for-big-road-construction-projects-in-orange-county/.

[49] Metropolitan Transportation Commission and Association of Bay Area Governments, *Bay Area Plan*: *A Strategy for A Sustainable Region* (July 18, 2013), available at http://files.mtc.ca.gov/pdf/Plan_Bay_Area_FINAL/Plan_Bay_Area.pdf.

[50] Greenbelt Alliance, *At Risk 2017* (May 2017), available at https://www.greenbelt.org/at-risk-2017/.

[51] Metropolitan Transportation Commission and Association of Bay Area Governments, *Draft Environmental Impact Report for Plan Bay Area 2040* (April 2017), available at http://2040.planbayarea.org/cdn/farfuture/JHbwWZgw24OSpVBL0b8cJ5_2KHOdckVexpxYp5McOkI/1499352691/sites/default/files/2017-07/PBA%202040%20DEIR_0_1.pdf.

such encroachment. In addition, Caltrans has a number of highway improvement projects planned in Santa Clara and San Mateo counties.[52]

There also is development pressure on the Pajaro Hills linkage, which is important to the Central Coast North mountain lion population and connects the Santa Cruz Mountains and Gabilan Range.[53] The Land Trust of Santa Cruz County notes that while a few large ranches cover most of the Pajaro Hills, many of the properties are parcelized, creating the potential for development which would fragment the landscape. Only 8 percent of the Pajaro Hills is permanently protected.

Growth is expected to increase in the Monterey Bay Area, leading to further fragmentation of natural habitats by urban or exurban development. The Association of Monterey Bay Area Governments predicts that the population in the Monterey Bay Area will rise from 755,403 in 2015 to 883,300 in 2040.[54] The Land Trust of Santa Cruz County notes that while high rates of conversion of forests, rangeland and farmland has largely been prevented in Santa Cruz County, exurban development, roads and mining are fragmenting wildlife habitat. Vineyard conversion adjacent to Zayante, Beer Creek, and Summit roads is causing habitat fragmentation in one of the largest intact habitat patches connecting Santa Cruz and Santa Clara counties. The Land Trust of Santa Cruz County estimates that only 44 percent of the large patches of intact habitat are protected. The Conservation Lands Network likewise confirms that much of the Santa Cruz Mountains do not currently qualify as protected areas.[55]

In San Luis Obispo County, the population is expected to increase by 41,650 between 2015 and 2045.[56] The sparsely populated North Coast region of San Luis Obispo County is currently characterized by ranchlands, rural development, and open space. However, the San Luis Obispo Council of Governments ("SLOCOG") predicts more population growth in this region as compared to other regions. SLOCOG also predicts significant increases in traffic volumes on Highway 101 throughout San Luis Obispo County. The US 101 Corridor Mobility Master Plan also contains various proposals to expand the Interstate 101 freeway in San Luis Obispo County, including adding more lanes to the freeway.[57] There are also proposals to widen portions of State Route 46, the western portions of which bisect mountain lion habitat. The Caltrans State Route 46 Corridor System Management Plan concedes that widening segments 2 and 3 of State Route 46 "could present additional barriers to animal movements by further

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[52] Caltrans District 4, *Projects By County*, available at http://www.dot.ca.gov/d4/projects_list.htm.
[53] Land Trust of Santa Cruz County, *A Conservation Blueprint* (May 2011), available at https://landtrustsantacruz.org/blueprint/conservation-blueprint_low-res_110522.pdf.
[54] Association of Monterey Bay Area Governments, *2040 Metropolitan Transportation Plan/Sustainable Communities Strategy* (June 2018), available at http://ambag.org/programs/met_transp_plann/documents/Final_2040_MTP_SCS/AMBAG_MTP-SCS_Final_EntireDocument.pdf.
[55] Conservation Lands Network, *1.0 Progress Report* (2014), available at https://www.bayarealands.org/wp-content/uploads/2017/07/CLN-1.0-Progress-Report.pdf.
[56] San Luis Obispo Council of Governments, *2019 Regional Transportation Plan Public Review Draft* (Feb. 2019), available at https://www.dropbox.com/s/6pysudp1g36n4a5/__Public%20Rev%20draft.pdf?dl=0 .
[57] San Luis Obispo County of Governments, *US 101Corridor Mobility Master Plan* (Sept. 2014), available at http://www.dot.ca.gov/hq/tpp/offices/ocp/5_SLOCOG%20101_executive_summary_draft_9%2019%2014.pdf.

dividing large, contiguous wildlife habitat areas."[58] There are numerous other road and highway expansion projects planned for Santa Cruz, Monterey, San Luis Obispo, and Santa Barbara counties.[59] The expansion of existing roads and highways along with increased numbers of automobiles will further impair connectivity in the Central Coast region.

9 CESA Listing for Southern California and Central Coast Mountain Lions Would Supplement Proposition 117's Protections.

9.1 CESA Listing is Consistent with Proposition 117.

CESA protections for Southern California and Central Coast mountain lions are consistent with and supplemental to those established by Proposition 117. Both CESA and Proposition 117 include "take prohibitions"—CESA makes it unlawful for any person or agency to import, export, take, possess, or purchase a listed species. (Cal. Fish & Game Code § 2080.) By the same token, Proposition 117 makes it unlawful to take, injure, possess, transport, import, or sell a mountain lion. (Cal. Fish & Game Code § 4800(b).)

Both CESA and Proposition 117's take prohibitions are subject to certain exceptions. Under CESA, CDFW may authorize that a person, agency, or institution take a listed species "for scientific, educational, or management purposes." (Cal. Fish & Game Code § 2081(a).) CESA defines scientific resources management activities to include "research, census, law enforcement, habitat acquisition, restoration and maintenance, propagation, live trapping, and, transplantation, and, in the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, [] regulated taking." (*San Bernardino Valley Audubon Society v. City of Moreno Valley* (1996) 44 Cal.App.4th 593, 604, quoting Cal. Fish & Game Code § 2061.) The regulations implementing CESA also allow for the take of a listed species for management or law enforcement purposes: "Department wildlife management activities. The possession or take of endangered, threatened, or candidate species by employees and agents of the Department for scientific, educational and management purposes, and for law enforcement purposes, is not prohibited." (Cal. Code Regs., tit. 14, § 783.1(c).) As discussed above in *Section 8 Inadequacy of Existing Regulatory Mechanisms*, Proposition 117 also contains exceptions which allow for the take of mountain lions in certain circumstances. These exceptions are sufficiently similar that in most cases take of mountain lions properly authorized by Proposition 117 could be consistent with CESA's exceptions for wildlife management activities or law enforcement purposes. (Cal. Code Regs., tit. 14, § 783.1(c).)

9.2 CESA Listing Would Further the Goals of Proposition 117.

CESA listing would further Proposition 117's goals of protecting and restoring wildlife habitat as human populations increase. (Cal. Fish & Game Code § 2780(a).) CESA listing would also help preserve "corridors of natural habitat [] to maintain the genetic integrity" of mountain lions in the Santa Monica Mountains, Santa Ana Mountains, Santa Susana Mountains, Simi Hills, and Coast Range. (Cal. Fish & Game Code § 2780(a).)

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[58] Caltrans, *State Route 46 Corridor System Management Plan* (June 2009), available at http://www.dot.ca.gov/hq/tpp/corridor-mobility/CSMPs/d5_CSMPs/SR%2046/SR-46%20CSMPo100.pdf.
[59] Caltrans District 5, *Projects By County*, available at http://www.dot.ca.gov/d5/.

Likewise, CESA requires that "reasonable and prudent alternatives" that will not jeopardize the existence of a listed species be developed in coordination with the project proponent and state lead agency consistent with conserving the listed species and maintaining the project purpose to the greatest extent feasible. (Cal. Fish & Game Code § 2053(b).) In the event that such alternatives are infeasible, individual projects may still be approved if appropriate mitigation measures are implemented. (Cal. Fish & Game Code § 2054.) CESA envisions these mandates will be incorporated into the CEQA process. (Cal. Fish & Game Code §§ 2064-2065; Cal. Code Regs., tit. 14, §§ 783.3 & 783.5.)

Consistent with Proposition 117, CESA further provides that it is the policy of the state to conserve and protect listed species and their habitat, including through acquiring lands for habitat. (Cal. Fish & Game Code § 2052.) Towards this end, CESA directs state agencies to utilize their authority to conserve listed species. (Cal. Fish & Game Code § 2055.) If the Southern California and Central Coast mountain lions were listed under CESA, this mandate would apply to, for example, Caltrans, which currently lacks a clear mandate to conserve these lions or habitat connectivity necessary for their continued survival.

CESA authorizes CDFW to develop and implement "nonregulatory recovery plans" for listed species with priority given to species that are or may be "significantly affected by anticipated land use changes, climate change, or changes in aquatic conditions." (Cal. Fish & Game Code §§ 2079.1(a) & (b).) Given the strong evidence that land use changes will significantly affect (and have already significantly affected) Southern California and Central Coast mountain lions, CDFW could develop and implement a recovery plan for these lions pursuant to this provision.

In sum, CESA listing would build upon the protections in Proposition 117 by establishing an affirmative duty to ensure the survival and recovery of the Southern California and Central Coast mountain lions by, *inter alia*, (1) prohibiting the approval of projects that could jeopardize their continued existence or result in destruction of essential habitat (Cal. Fish & Game Code § 2053(a)); (2) requiring state agencies such as Caltrans to utilize their authority to conserve listed species (Cal. Fish & Game Code § 2055); and (3) requiring appropriate mitigation measures be implemented for projects that could destroy mountain lion habitat or impair connectivity (Cal. Fish & Game Code § 2054).

To the extent there is any tension between the provisions in Proposition 117 and CESA, Proposition 117 is to be "liberally construed to further its purposes." (Prop. 117 § 9.) Because Proposition 117 and CESA both have similar purposes, Proposition 117 should be construed to be consistent with CESA.

10 Recommended Management and Recovery Actions

Recommendations for the management and recovery of Southern California and Central Coast mountain lion populations are as follows:

1. Design and build crossing infrastructure in strategic locations to improve wildlife connectivity and permeability at existing roads and highways. Crossing infrastructure should include but is not limited to overcrossings, underpasses, culverts, and exclusionary fencing that guides animals to safer crossing areas. The following crossing locations have been identified by mountain lion experts and should be prioritized for the implementation of crossing infrastructure: 1) I-15 Freeway at Temecula Creek Bridge to enhance the Palomar Linkage and connect the Santa Ana and Eastern Peninsular Mountain Ranges (Gustafson et al. 2017; Zeller et al. 2017; Ernest et al. 2014; Riley et al. 2018); 2) I-15 Freeway at "Site 5" as described in Riley et al. (2018); 3) Hwy-101 at West Liberty Canyon. (Riley et al. 2018.)

2. Improve or add large culverts to existing freeways in areas suitable for mountain lion crossing. (Vickers 2015).

3. Dedicate sufficient Wildlife Conservation Board, Habitat Conservation Fund and other state funding sources towards acquiring key mountain lion habitat and for establishment of highway crossing infrastructure.

4. Ensure that suitable habitat exists (through preservation or restoration/enhancement) on both sides of crossing structures and culverts (South Coast Wildlands 2008). Restrict human activity near crossing structures and relocate foot trails away from these structures (South Coast Wildlands 2008).

5. Fully protect mountain lion habitat, including resource-use patches and corridors (Zeller et al. 2017; Vickers et al. 2015). Prohibit large-scale development in primary travel corridors and habitat linkages, such as in and around the last remaining linkage for statewide genetic connectivity in the Tehachapi and Sierra Pelona Mountains (Gustafson et al. 2018) and in corridor areas between the SAM and EPR (Gustafson et al. 2017).

6. Require analysis of region-wide wildlife connectivity in all new development proposals (Gustafson et al. 2018).

7. Reduce depredation conflicts that precipitate mountain lion deaths (Vickers et al. 2015). Develop and implement outreach and education activities to promote use of predator-proof enclosures for domestic animals. (Vickers et al. 2015.) Expand CDFW's new three-step depredation permit policy in the CC-S and SAM areas to include all mountain lions across the state, or at a minimum, within the SGSB, EPR, CC-N, and CC-C population areas. Enhance the policy with enforceable implementation of non-lethal protective measures and reporting requirements.

8. Prohibit the use of second-generation anticoagulant rodenticides ("SGARs"), such as brodifacoum, bromadiolone, difenacoum, and difethialone in Southern California and Central Coast mountain lions' core habitat areas and linkages. Limit the use of other pesticides and herbicides that may have negative effects on mountain lion populations in Southern California and the Central Coast.

9. Identify “priority areas” for establishing wildlife passage features for the Southern California and Central Coast mountain lions using the best available science, including data collected by various agencies, academic institutions, and organizations, including but not limited to the National Park Service, the Karen C. Drayer Wildlife Health Center at UC Davis, the Road Ecology Center at UC Davis, and the Santa Cruz Puma Project at UC Santa Cruz.

10. Require Caltrans to analyze how projects in the State Highway Operation Protection Program and State Transportation Improvement Program can be designed to facilitate wildlife connectivity through wildlife passage features such as culverts, undercrossings, overcrossings, bridges, directional fencing, scuppers, barrier breaks, roadside animal detection systems, etc. Require Caltrans to collect and analyze roadkill data to identify hotspots where mountain lions are killed. Require Caltrans to implement wildlife passage features to the greatest extent feasible and as expeditiously as possible.

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State of California
Department of Fish and Wildlife

Received on February 6, 2020
Signed copy on file.

Memorandum

Date: January 31, 2020

To: Melissa Miller-Henson
Executive Director
Fish and Game Commission

From: Charlton H. Bonham
Director

Subject: Evaluation of a Petition to List the Southern California/Central Coast Evolutionarily Significant Unit (ESU) of Mountain Lion as Threatened under the California Endangered Species Act

The California Department of Fish and Wildlife (Department) has completed its evaluation of a Petition to list the proposed Southern California/Central Coast Evolutionarily Significant Unit (ESU) of Mountain Lion as a threatened species under the California Endangered Species Act, Fish and Game Code section 2050 et seq. The California Fish and Game Commission (Commission) received the Petition from The Center for Biological Diversity and The Mountain Lion Foundation on June 25, 2019. Pursuant to Fish and Game Code section 2073, the Commission referred the Petition to the Department on July 5, 2019. In accordance with Fish and Game Code section 2073.5, subdivision (b), in August 2019 the Department requested, and the Commission approved, a 30-day extension to complete its evaluation report.

The Department completed the attached Petition Evaluation report pursuant to Fish and Game Code section 2073.5. (See also Cal. Code Regs., tit. 14, § 670.1, subd. (d)(1).). The Department's evaluation report delineates the categories of information required in a petition, evaluates the sufficiency of the available scientific information regarding each of the Petition components, and incorporates additional relevant information the Department possessed or received during the review period. Based upon information contained in the petition and other relevant information in the Department's possession, the Department has determined there is sufficient scientific information available at this time to indicate the petitioned action may be warranted. The Department recommends the Petition be accepted and considered.

If you have any questions or need additional information, please contact Ms. Kari Lewis, Wildlife Branch Chief, at (916) 445-3789 or by email at Kari.Lewis@wildlife.ca.gov.

Attachment

ec: **California Department of Fish and Wildlife**

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State of California
Natural Resources Agency
Department of Fish and Wildlife

REPORT TO THE FISH AND GAME COMMISSION

EVALUATION OF A PETITION FROM THE CENTER FOR BIOLOGICAL DIVERSITY AND THE MOUNTAIN LION FOUNDATION TO LIST THE SOUTHERN CALIFORNIA/CENTRAL COAST EVOLUTIONARILY SIGNIFICANT UNIT (ESU) OF MOUNTAIN LIONS AS THREATENED UNDER THE CALIFORNIA ENDANGERED SPECIES ACT

Photo: Donna Krucki

Prepared by
California Department of Fish and Wildlife

Final Review Draft January 31, 2020

I. Executive Summary

The Center for Biological Diversity and the Mountain Lion Foundation (Petitioners) submitted a Petition (Petition) to the Fish and Game Commission (Commission) to list a Southern California/Central Coast Evolutionarily Significant Unit (ESU) of mountain lions (Puma concolor), or one or more of the six subpopulations, singularly or in combination within the proposed ESU as threatened or endangered pursuant to the California Endangered Species Act (CESA), Fish and Game Code Section 2050 et seq.

The Commission referred the Petition to the Department of Fish and Wildlife (Department) in accordance with Fish and Game Code Section 2073 (Cal. Reg. Notice Register 2019, No. 30-Z, p. 1086). Pursuant to Fish and Game Code section 2073.5 and California Code of Regulations, title 14, section 670.1, the Department prepared this evaluation report (Petition Evaluation) of the Petition. The purpose of the Petition Evaluation is to assess the scientific information discussed and cited in the Petition in relation to other relevant and available scientific information possessed or received by the Department during the evaluation period and to recommend to the Commission whether the scientific information in the Petition is sufficient under the criteria prescribed by CESA to accept and consider the Petition to list the mountain lions within the proposed ESU as threatened or endangered.

After reviewing the Petition and other relevant information, the Department determined the following:

- Population Trend. The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition indicated the overall population trend for the proposed ESU of mountain lions has declined, and continues to decline, with six genetically distinct subpopulations identified within the proposed ESU.

- Range. The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition contains a detailed description and maps of the geographic range of mountain lions within the proposed ESU.

- Distribution. The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition discusses the distribution of mountain lions within the proposed ESU and

demonstrates a reduction in their distribution due to habitat loss, conversion, and fragmentation throughout much of the historical range, along with habitat degradation and near isolation for some subpopulations due to major highways.

- Abundance. The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition contains a description of abundance estimates for mountain lions in the proposed ESU based on several recent tracking and genetic studies. Scientific publications from these studies indicate small subpopulation sizes.

- Life History. The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition describes life history of the mountain lion, including taxonomy, biology, reproduction, diet, foraging ecology, habitat requirements, survivorship, and home range size. Additionally, evidence of potential inbreeding depression for some subpopulations is described.

- Kind of Habitat Necessary for Survival. The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition describes habitat types, home range requirements, prey resources, and other conditions necessary for viable mountain lion populations. The importance of functional movement corridors between habitat patches, preservation of existing habitat, and adequate buffers from effects of human development, roads, and highways are described.

- Factors Affecting the Ability to Survive and Reproduce. The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition presents information to indicate that mountain lions within the proposed ESU have experienced habitat loss and habitat fragmentation leading to small, isolated subpopulations with a lack of adequate gene flow between them. The genetic diversity of some small subpopulations in the proposed ESU is nearly as low as a federally endangered subspecies, the Florida panther (*Puma concolor coryi*). Additionally, other sources of human-caused mortality, such as vehicle strikes, and deterioration or destruction of movement corridors may affect the ability of mountain lions to

survive and reproduce.

- Degree and Immediacy of Threat. The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition discusses the threats to long-term survival of mountain lions within the proposed ESU and states the threats will continue to worsen due to development, coupled with associated roads and other infrastructure that reduces habitat size and quality, and leads to a decrease in habitat connectivity. These threats may contribute to the loss of genetic diversity and further increase the risk of inbreeding depression, which can compromise long term population viability.

- Impact of Existing Management Efforts. The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition discusses how existing regulatory mechanisms and management efforts do not adequately protect mountain lions within the proposed ESU from impacts that threaten their long-term survival. In particular, the Petition indicates that land use planning and habitat conservation needs to occur at a larger scale and include habitat connectivity for mountain lions and their prey, while also lessening human-caused mortality factors such as vehicle strikes, and depredation take.

- Suggestions for Future Management. The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition includes potential management actions that would benefit mountain lions (e.g., wildlife crossing structures over or under freeways and major roads), and cites studies that contain a number of suggestions for future management (e.g., better land use planning for sufficient habitat connectivity and gene flow, and for conservation of prey species).

- A Detailed Distribution Map. The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition contains a detailed distribution map of mountain lion populations within the proposed ESU and adjacent populations in California and Nevada.

- Availability and Sources of Information. The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that

it include sufficient scientific information to indicate the petitioned action may be warranted. More than 140 references were cited in the Petition and the Petitioner provided portable document file (.pdf) copies of the majority of the referenced documents to the Commission.

The Department's Petition Evaluation focuses on analyses of the scientific information provided in the Petition, as well as additional scientific information the Department possesses, or has knowledge of, regarding mountain lion populations including populations within the proposed ESU.

In completing its Petition Evaluation, the Department has determined the Petition provides sufficient scientific information to indicate the petitioned action may be warranted. Therefore, the Department recommends the Commission accept the Petition for further consideration pursuant to Fish and Game Code section 2074.2.

II. Introduction

A. Candidacy Evaluation

The Commission has the authority to list certain "species" or "subspecies" as threatened or endangered under CESA. (Fish & G. Code, §§ 2062, 2067, 2070.) The listing process is the same for species and subspecies. (Fish & G. Code, §§ 2070-2079.1.)

CESA sets forth a two-step process for listing a species as threatened or endangered. First, the Commission determines whether to designate a species as a candidate for listing by evaluating whether the petition provides "sufficient information to indicate that the petitioned action may be warranted." (Fish & G. Code, § 2074.2, subd. (e)(2).) If the petition is accepted for consideration, the second step requires the Department to produce, within 12 months of the Commission's acceptance of the petition, a peer reviewed report based upon the best scientific information available that advises the Commission whether the petitioned action is warranted. (Fish & G. Code, § 2074.6.) Finally, the Commission, based on that report and other information in the administrative record, then determines whether the petitioned action to list the species as threatened or endangered is warranted. (Fish & G. Code, § 2075.5.)

A petition to list a species under CESA must include "information regarding the population trend, range, distribution, abundance, and life history of a species, the factors affecting the ability of the population to survive and reproduce, the degree and immediacy of the threat, the impact of existing management efforts, suggestions for future management, and the availability and sources of information. The petition shall also include information regarding the kind of habitat necessary for species survival, a detailed distribution map, and any other factors that the petitioner deems relevant." (Fish & G. Code, § 2072.3; see also Cal. Code Regs., tit. 14, § 670.1, subd. (d)(1).) The

range of a species for the Department's petition evaluation and recommendation is the species' California range. (Cal. Forestry Assn. v. Cal. Fish and Game Com. (2007) 156 Cal. App. 4th 1535, 1551.)

Within 10 days of receipt of a petition, the Commission must refer the petition to the Department for evaluation. (Fish & G. Code, § 2073.) The Commission must also publish notice of receipt of the petition in the California Regulatory Notice Register. (Fish & G. Code, § 2073.3.) Within 90 days of receipt of the petition (or 120 days if the Commission grants an extension), the Department must evaluate the petition on its face and in relation to other relevant information and submit to the Commission a written evaluation report with one of the following recommendations:

- Based upon the information contained in the petition, there is not sufficient information to indicate that the petitioned action may be warranted, and the petition should be rejected; or
- Based upon the information contained in the petition, there is sufficient information to indicate that the petitioned action may be warranted, and the petition should be accepted and considered.

(Fish & G. Code, § 2073.5, subds. (a)-(b).) The Department's candidacy recommendation to the Commission is based on an evaluation of whether the petition provides sufficient scientific information relevant to the petition components set forth in Fish and Game Code Section 2072.3 and the California Code of Regulations, Title 14, Section 670.1, subdivision (d)(1).

In Center for Biological Diversity v. California Fish and Game Commission (2008) 166 Cal.App.4th 597, the California Court of Appeals addressed the parameters of the Commission's determination of whether a petitioned action should be accepted for consideration pursuant to Fish and Game Code Section 2074.2, subdivision (e), resulting in the species being listed as a candidate species. The court began its discussion by describing the standard for accepting a petition for consideration previously set forth in Natural Resources Defense Council v. California Fish and Game Commission (1994) 28 Cal.App.4th 1104:

> As we explained in Natural Resources Defense Council, "the term 'sufficient information' in section 2074.2 means that amount of information, when considered with the Department's written report and the comments received, that would lead a reasonable person to conclude the petitioned action may be warranted." The phrase "may be warranted" "is appropriately characterized as a 'substantial possibility that listing could occur.'" "Substantial possibility," in turn, means something more than the

> one-sided “reasonable possibility” test for an environmental impact report but does not require that listing be more likely than not.

(Center for Biological Diversity, supra, 166 Cal.App.4th at pp. 609-10 [internal citations omitted].) The court acknowledged that “the Commission is the finder of fact in the first instance in evaluating the information in the record.” (Id. at p. 611.) However, the court clarified:

> [T]he standard, at this threshold in the listing process, requires only that a substantial possibility of listing could be found by an objective, reasonable person. The Commission is not free to choose between conflicting inferences on subordinate issues and thereafter rely upon those choices in assessing how a reasonable person would view the listing decision. Its decision turns not on rationally based doubt about listing, but on the absence of any substantial possibility that the species could be listed after the requisite review of the status of the species by the Department under [Fish and Game Code] section 2074.6.

(Ibid.)

B. Petition History

The Petitioner is soliciting review for a threatened or endangered species determination of a proposed Southern California/Central Coast Evolutionarily Significant Unit (ESU) of mountain lions (Puma concolor), or one or more of the six subpopulations, singularly or in combination within the proposed ESU as threatened or endangered pursuant to the California Endangered Species Act (CESA), Fish and Game Code Section 2050 et seq.

On June 25, 2019, the Commission received a petition to list the Southern California/Central Coast ESU of mountain lions under CESA. On July 5, 2019, the Commission referred the Petition to the Department for evaluation. In August 2019, the Department requested, and the Commission granted, a 30-day extension of the 90-day Petition evaluation period. The Department submitted this Petition Evaluation report to the Commission on January 31, 2020.

The Department evaluated the scientific information presented in the Petition as well as other relevant information the Department possessed at the time of review. The Commission did not receive new scientific information from the public during the Petition Evaluation period pursuant to Fish and Game Code section 2073.4. Pursuant to Fish and Game Code section 2072.3 and California Code of Regulations, title 14, section 670.1, subdivision (d)(1), the Department evaluated whether the Petition included sufficient scientific information regarding each of the following petition components to indicate whether the petitioned action may be warranted:

- Population trend.
- Range.
- Distribution.
- Abundance.
- Life history.
- Kind of habitat necessary for survival.
- Factors affecting the ability to survive and reproduce.
- Degree and immediacy of threat.
- Impact of existing management efforts.
- Suggestions for future management.
- A detailed distribution maps.
- Availability and sources of information; and

C. Overview of Mountain Lion Ecology

Mountain lions (Puma concolor) belong to the order Carnivora and are members of the cat family Felidae. Common names are many and include puma, cougar, or panther. In California, mountain lions can range from near sea level to the higher mountain slopes and some desert areas (Grinnell et al. 1937, Young and Goldman 1946). Although they occur at low densities, they were once widespread in North America (Pierce and Bleich 2003). Adults are large and slender with short muscular limbs and a long black-tipped tail that is about one third of the animal's total length. Males are typically larger than females. Male mountain lions generally weigh 121 to 143 pounds (55 to 65kg) with a length of 7.2 to 7.5 feet (2.2 to 2.3m) from nose to tail tip, and female lions generally weigh 77 to 99 pounds (35 to 45kg) with a length of 6.6 to 6.9 feet (2.0 to 2.1m) (Currier 1983).

Mountain lions reach sexual maturity at two to four years of age, and females care for their young for one to two years. They have a polygynous social structure, and males do not contribute to rearing young. Mates likely locate each other with auditory and olfactory signals (Currier 1983). Gestation lasts 82 to 96 days (Young and Goldman 1946, Currier 1983). Litter size ranges from one to six, though two to four kittens per litter are typical (Pierce and Bleich 2003, Beier et al 2010, Riley et al. 2014). Denning mountain lions have been found to avoid roads and stay at a distance from human disturbance four times greater than non-reproductive mountain lions (Wilmers et al. 2013).

Large ungulates, especially deer, are the preferred prey of mountain lions, making up about 70% of their diet. However, mountain lions are opportunistic predators, and they have been documented eating a wide variety of other large and smaller prey, including moose, elk, wild horses, burros, pronghorn antelope, bighorn sheep, mountain goats,

wild pigs, coyotes, bobcats, porcupines, fishers, badgers, rabbits, raccoons, rodents, turkeys, and livestock (Currier 1983, Iriarte et al. 1990, Wengert et al. 2014, Allen et al. 2015, Garcelon unpublished data).

Mountain lions are primarily solitary, territorial, and occur in low density. They require large areas of relatively undisturbed habitat with adequate prey abundance, and habitat connectivity to allow for successful dispersal and gene flow. They have large home ranges that include heterogenous habitats including riparian, chaparral, oak woodlands, coniferous forests, grasslands, and occasionally in rocky desert uplands (Grinnell 1914, Grinnell et al. 1937, Williams 1986, Dickson et al. 2005, McClanahan et al. 2017).

As a top carnivore with no natural predators, predation by other mountain lions and death due to human activity, such as vehicle strikes and depredation take, are the main drivers of mountain lion mortality (Grinnell et al. 1937, Beier and Barrett 1993, Wilmers et al. 2013, Riley et al. 2014, Vickers et al. 2015). Weaver (1982) also noted the gradual reduction of mountain lion habitat over time as a concern.

III. Sufficiency of Scientific Information to Indicate the Petitioned Action May Be Warranted

The Petition components are evaluated below, with respect to Fish and Game Code section 2072.3 and California Code of Regulations, title 14, section 670.1, subdivision (d)(1).

A. Population Trend

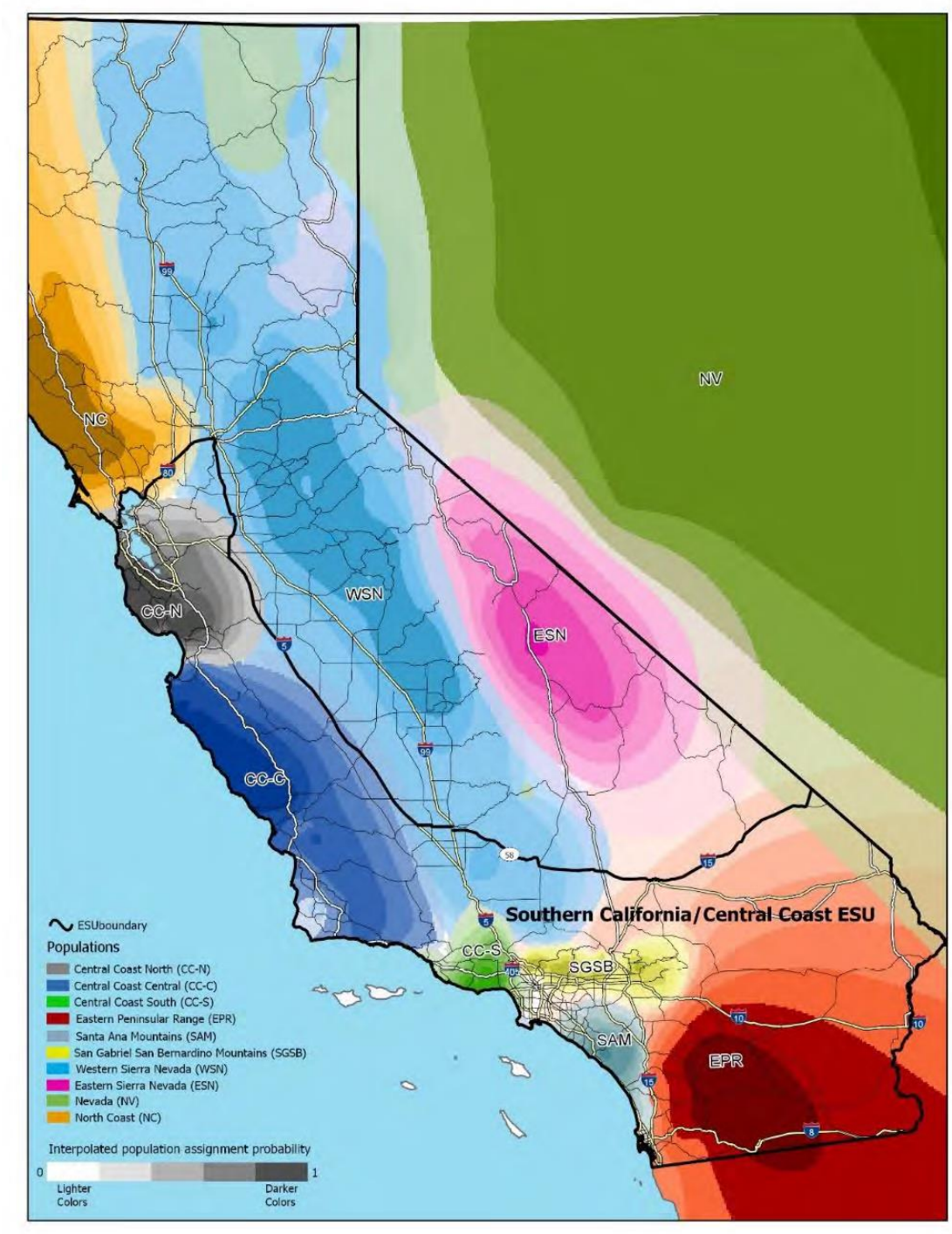
1. Scientific Information in the Petition

The Petition discusses mountain lion population status and trend on pages 34 through 40 and presents past population estimates made by the Department (see Abundance section below). Population trend is difficult to determine without estimates of population size for various years. The Petition acknowledges a lack of population trend data and therefore relies upon habitat mapping coupled with known distribution of mountain lions, along with estimated population sizes for the six subpopulations within the proposed ESU. The estimated mountain lion population sizes are based on field studies and recent genetic information which suggest a negative population trend (Ernest et al. 2003, Ernest et al. 2014, Benson et al. 2016, Gustafson et al. 2017, Gustafson et al. 2018, Benson et al. 2019).

The proposed ESU, as described in the Petition, includes six genetic subpopulations of mountain lions: 1) Central Coast North (CC-N), which includes the Santa Cruz Mountains; 2) Central Coast Central (CC-C), generally from southern Monterey Bay to the Ventura area; 3) Central Coast South (CC-S), which includes the Santa Monica

Mountains; 4) San Gabriel/San Bernardino Mountains (SGSB); 5) Santa Ana Mountains (SAM); and 6) Eastern Peninsular Range (EPR), which includes eastern San Diego County to the Colorado River and is bounded on the north by Interstate 15 (Petition Figure ES 1). The heavy black line surrounding the six genetic subpopulations outlines the proposed ESU boundary. Interstate freeways and major highways are utilized to define the proposed ESU boundary from a habitat and management perspective while also factoring in known distribution of mountain lions, and recognizing the need to maintain gene flow between the relatively large Western Sierra Nevada population of mountain lions and the smaller genetic subpopulations in the proposed ESU.

The Petition notes mountain lion populations in the Western Sierra Nevada (WSN) and Eastern Sierra Nevada (ESN) were the greatest genetic source populations, but exhibited limited gene flow with lion subpopulations along the central coast of California (CC-N, CC-C, CC-S), and neither Nevada (NV) or the North Coast (NC) mountain lions exhibited appreciable gene flow with central coast populations (Petition Figure ES 1). The SAM population exhibited gene flow only with the EPR population, and the EPR population had low connectivity with the SGSB population. The mountain lion population in the Transverse Ranges (SGSB) was the largest genetic sink but exchanged some genetic material with the WSN, CC-C, and EPR populations. Populations in the southern mountain ranges (SAM, EPR) were largely disconnected from all other populations (Gustafson et al. 2018).



Petition Figure ES 1.
Map of genetically distinct mountain lion populations and major roadways in California based on data collected from 1992-2016 (the division and status of these populations could change over time and with further research). The black lines show the proposed Southern California/Central Coast ESU boundary. Derived from Gustafson et al. (2018). Genetics data source: Kyle Gustafson, PhD, Department of Biology and Environmental Health, Missouri Southern State University, and Holly Ernest, DVM, PhD, Department of Veterinary Sciences, Program in Ecology, University of Wyoming, Laramie. Roads data source: ESRI.

As discussed earlier, genetic samples of mountain lions have allowed population size estimates to be made for the proposed ESU subpopulations by using current genetic analysis techniques (Ernest et al. 2003, Ernest et al. 2014, Gustafson et al. 2017, Gustafson et al. 2018). The results of the analyses are presented below for the six mountain lion subpopulations in the proposed ESU (Petition Table 1). Mountain lion population estimates in the table depict the ratio of effective population size (Ne) to total adult population size (Ne/N). Effective population size generally refers to the breeding adults in a population, in recognition of the fact that all adult animals in a population may not breed.

Petition Table 1.

Table 1. Effective population size and estimated total adult population of Central Coast and Southern California Mountain Lion Populations from Gustafson et al. (2018).

Population	Effective Population Size (N_e)	Estimated Total (Adult) Population (N)[1]
Central Coast North (CC-N)	16.6	33-66
Central Coast Central (CC-C)	56.6	113-226
Central Coast South (CC-S)	2.7[2]	5-10
Santa Ana Mountains (SAM)	15.6[3]	31-62
San Gabriel/ San Bernardino Mountains (SGSB)	5	10-20
Eastern Peninsular Range (EPR)	31.6	63-126
Total		255-510

[1]Calculations are based on the estimated ratio of effective to total adult population size (Ne/N) of Florida panthers being 0.25 to 0.5 (Ballou et al. 1989). This ratio was used in the U.S. Fish and Wildlife Service Florida Panther Recovery Plan (USFWS 2008). Petitioners recognize that these derived population estimates, while informative, are not definitive and will likely be superseded by new population estimates being developed by the Department (CDFW 2018a).

[2]Benson et al. (2019) calculated an Ne of 4 for the Santa Monica Mountains population within the CC-S. Applying the Ballou et al. (1989) factors would lead to an estimate of 8-16 mountain lions in this area, which is roughly consistent with current estimates of this well-monitored population.

[3]Several studies provide Ne calculation for the SAM population. Ernest et al. (2014) calculated an Ne of 5.1 and Benson et al. (2019) calculated an Ne of 6. Applying the Ballou et al. (1989) factors to the most recent calculation would lead to an estimate of 12-24 mountain lions in the SAM, which is roughly consistent with current estimates.

The Petitioners also acknowledged the Ne/N methodology has limitations and is but one method of generating an overall abundance estimate. Studies are needed to more accurately determine regional and statewide mountain lion population size and trend, but most of the genetic subpopulations within the proposed ESU are struggling with low population sizes, and genetic near-isolation leading to low genetic diversity which puts them at increased risk of extinction (Beier 1993, Beier 1995, Dickson et al. 2005, Ernest et al. 2014, Riley et al. 2014, Vickers et al. 2015, Benson et al. 2016, Gustafson et al. 2018, Benson et al. 2019).

The Petition noted that due to extreme isolation caused by roads and development, the SAM and CC-S populations exhibit high levels of inbreeding, and with the exception of the endangered Florida panther, have the lowest genetic diversity observed for the species globally (Ernest et al. 2014, Riley et al. 2014, Gustafson et al. 2018, Benson et al. 2019). The SGSB and CC-N similarly have low observed genetic diversity and effective population sizes, and the mountain lions occupy areas of significant isolation and habitat fragmentation, which also increases their risk for inbreeding depression (Gustafson et al. 2018).

Two long-term studies on radio-collared mountain lions in the SAM provide some insight into population trend for that small population (Beier 1993, Vickers et al. 2015). In a study that consisted of 32 radio-collared lions in the SAM from 1988 to 1993, researchers found a 75% adult survival rate (Beier and Barrett 1993), which is similar to adult survival rates in other populations, e.g., the CC-S population (Riley et al. 2014). However, in a second, more recent study conducted in the SAM, 31 mountain lions were marked from 2001 to 2013 and researchers found a reduced survival rate of 56.5% across all sexes and age groups (Vickers et al. 2015).

2. Conclusion

The petition includes a discussion of the available peer reviewed scientific information on mountain lion population trends. The petition on its face includes sufficient information to indicate the petitioned action may be warranted. The population trend information in the petition is based on an emerging methodology that will require further evaluation to assess the population trend of the proposed ESU that is the subject of the petitioned action.

The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition provided adequate information to indicate mountain lion populations in the proposed ESU have declined since the historical period based on known habitat loss and fragmentation, loss and reduction of habitat connectivity, and human-caused mortality factors (vehicle strikes, and depredation

take). The Petition also presents results of field and genetic studies that indicate low effective population sizes, low genetic diversity, and evidence of inbreeding.

B. Geographic Range

1. Scientific Information in the Petition

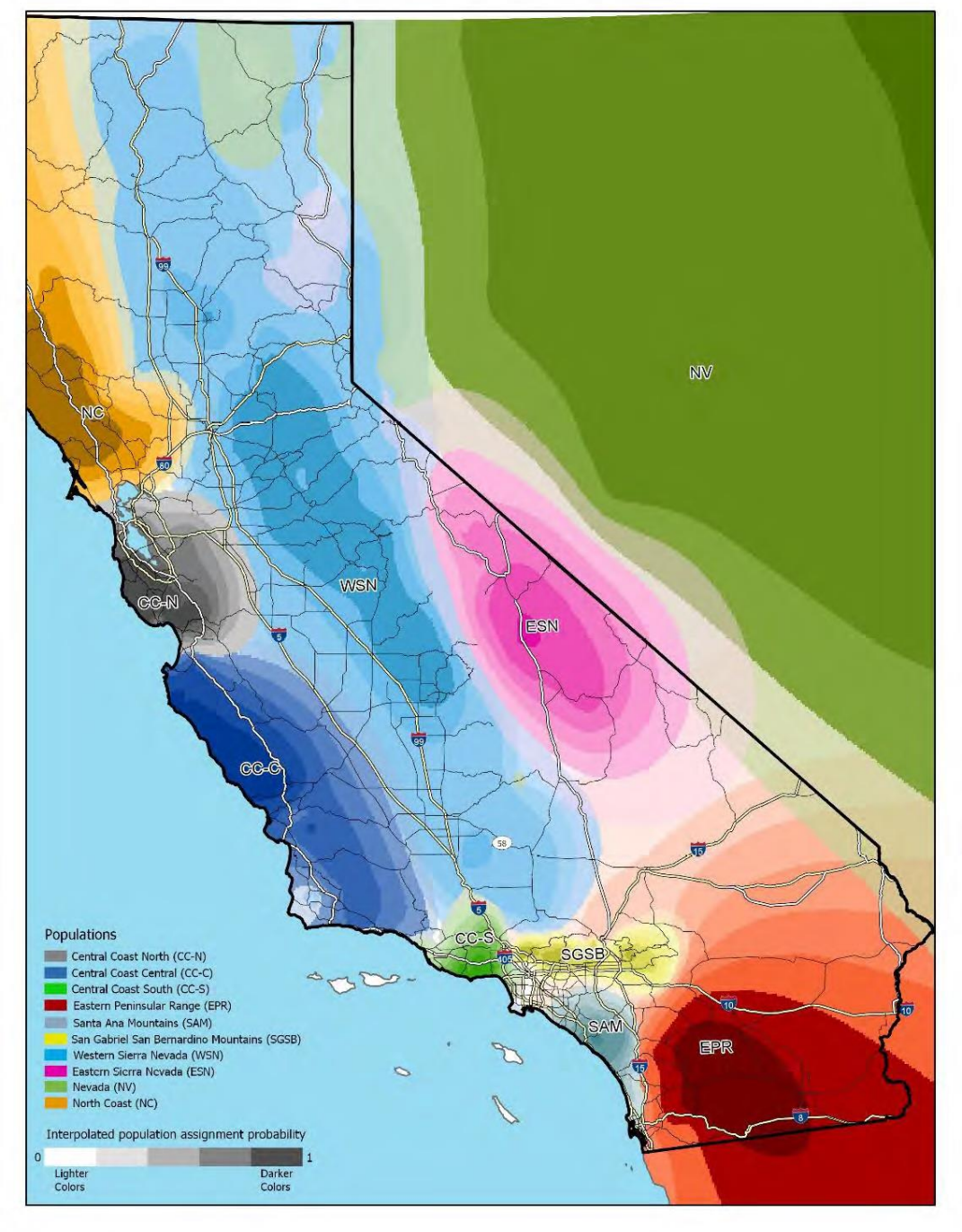
Information regarding geographic range is discussed on pages 30 through 33 of the Petition and indicates a decline in range based on habitat loss and fragmentation due to development. The Petition included a map to depict the constraints on mountain lion dispersal and gene flow between habitat patches within the proposed ESU, and for southern California mountain lion habitat in particular (Petition Figure 8). The Petition describes the major roads and Interstate freeways displayed as obstacles and potential sources of mortality for foraging and dispersing mountain lions that also contribute to reduction in geographic range. The urbanized landscape and highway network may also restrict mountain lion immigration into the southern California mountain lion populations from the more genetically diverse WSN and EPR subpopulations.

The Petition describes that the highly urbanized zone spreading out from the greater Los Angeles area, and generally continuing down the coastal zone to San Diego county demonstrates the habitat isolation problem for the CC-S, SGSB, and SAM mountain lion populations (Vickers et al. 2015, Benson et al. 2016, Gustafson et al. 2018, Benson et al. 2019). The EPR population is also affected by human development and road networks, but to a slightly lesser degree than the aforementioned three smaller populations. CC-N mountain lion populations are likewise losing geographic range and being constricted by development and highways in the Santa Cruz Mountains and the southern San Francisco Bay Area (Wilmers 2014, Wang et al. 2017).

Reduction in geographic range is expected to continue for mountain lions in southern California. A study of geographic range for mountain lions in the SAM and EPR subpopulations showed that nearly half of lion habitat in the study area is on private land, and approximately 1/3 of those lands available in 1970 will be developed by 2030. Additionally, some habitat that is currently adjacent to development may become fragmented, with potential loss of connectivity and increased risk to mountain lions from vehicle strikes and depredation take. Most additional suburban and urban development projected for 2030 will occur in areas that were classified as undeveloped or rural in 2000, but 2% of the current exurban area will be converted to suburban/urban (Burdett et al. 2010).

The Petition notes that although genetic subpopulations have been identified in southern California mountain ranges, mountain lions have been detected outside of the CC-S, SAM, SGSB, and EPR core areas, including transient and resident mountain lions in the Mojave and Colorado deserts and along the lower Colorado River (Grinnell

1914, Grinnell et al. 1937, Young and Goldman 1946, Williams 1986, Kucera 1998, Dellinger et al. 2019 in press). Mountain lions have also been documented within approximately 40 miles of the Colorado River on the Kofa National Wildlife Refuge in Arizona (Smythe 2008).



Petition Figure 8. Map of genetically distinct mountain lion populations and major roads in California. The CC-S (which includes the Santa Monica Mountains), SGSB, and SAM populations are exceptionally constrained. The map is based on data collected from 1992-2016 (the division and status of these

populations could change over time and with further research). Derived from Gustafson et al. (2018). Genetics data source: Kyle Gustafson, PhD, Department of Biology and Environmental Health, Missouri Southern State University, and Holly Ernest, DVM, PhD, Department of Veterinary Sciences, Program in Ecology, University of Wyoming, Laramie. Roads data source: ESRI.

The Yuma mountain lion (Puma concolor browni) is designated by the Department as a subspecies of special concern (Williams 1986, Kucera 1998, CDFW 2019). However, McIvor et al. (1995) and Culver et al. (2000) detected little morphological or genetic support for retention of the P.c. brownii subspecies. Until the genetic structure of desert lions is analyzed via newer genomic techniques, it is difficult to determine how important these southeastern California lions are to the genetic makeup of the EPR subpopulation, or if the western part of northern Mexico is a primary genetic source for the EPR lions. This unique area of California is discussed further in the Distribution section, below.

The desert lion populations occur in low densities, likely due to lower quality habitat and lower prey abundance. The Petition includes these low-density transients and resident lions within the proposed ESU.

2. Conclusion

The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition presented adequate information on habitat loss and fragmentation to demonstrate a decline in the geographic range of mountain lions in the proposed ESU.

C. Distribution

1. Scientific Information in the Petition

The Petition discusses current and historical distribution on pages 30 through 33.

As discussed earlier in this Petition Evaluation, mountain lions occur from near sea level to the higher mountain slopes and some desert areas in California (Grinnell et al. 1937, Young and Goldman 1946). They have large home ranges that include heterogenous habitats including riparian, chaparral, oak woodlands, coniferous forests, grasslands, and occasionally in rocky desert uplands (Grinnell 1914, Grinnell et al. 1937, Williams 1986, Dickson et al. 2005, McClanahan et al. 2017). However, mountain lions have a limited distribution in the Central Valley, which could relate to lower availability of deer, their primary prey source. Early agricultural development and loss of riparian habitat, along with other development and habitat loss in the Central Valley may also be a factor in their scarcity in this region of the state, though dispersing lions have occasionally been documented in the Central Valley. Mountain lions were recently detected via

wildlife cameras in the northern Central Valley near Butte Sink where some riparian habitat is still present (McClanahan et al. 2017).

In regard to the EPR subpopulation in southern California, the Petition states that limited studies have occurred regarding the northern, southern, and eastern extent of the lion population, genetic studies on the Yuma mountain lion are limited, and no samples were obtained from that area for the study conducted by Gustafson et al. (2018). However, movement patterns between 2001 and 2016 suggest that EPR mountain lions generally stay north of the U.S. – Mexico border, along the edge of the desert that borders the east side of the EPR, and south of I-10 (Vickers et al. 2015, Vickers et al. 2017). Although the EPR population has been found to be largely disconnected from all other California populations, some mountain lion movement was documented traversing between the EPR and SGSB (Vickers et al. 2015), and evidence exists of limited genetic exchange between the two populations (Gustafson et al. 2018). In addition, one young male mountain lion was documented to the south using the Parque-to-Park Linkage to cross the U.S. - Mexico border several times (where a border wall is lacking due to the rugged terrain); but that lion was eventually killed in Mexico by a vehicle strike (Vickers et al. 2015; W. Vickers unpublished data). Little is known about the mountain lions south of the border, but the movement patterns of EPR mountain lions suggest they may form a discrete population within the EPR north of the border (Vickers et al. 2015, Vickers et al. 2017).

The Petition highlights that more information on mountain lion abundance, distribution, and dispersal is needed from the Colorado River and eastern desert areas of California, along with that for lion populations in Arizona and Mexico (Williams 1986, Kucera 1998). At this time, there is inadequate information and a lack of genetic samples for these outlying areas of the EPR genetic subpopulation (McIvor et al. 1995, Vickers et al. 2015, Gustafson et al. 2018).

2. Other Relevant Scientific Information

In regard to the former distribution of Yuma mountain lions along the Colorado River in California, Grinnell (1914:page 251) stated: “We were told of the occurrence of cougars at several points along the river from Riverside Mountain south”; and he purchased two cougar skins with skulls from a rancher. At that time, mountain lions in the region were designated as Felis oregonensis browni and found along the lower Colorado River in California. Later, he described the “Yuma mountain lion” (Felis concolor browni) as “Now very rare, perhaps extinct” (Grinnell et al. 1937: page 587).

The swimming ability of mountain lions is described in Bruce (1921) and Young and Goldman (1946:pages 63 and 81), documenting that mountain lions can swim and are able to cross rivers.

One recent publication, not discussed in the Petition, documented mountain lion occurrence in the eastern part of Marin County, where prior information was mostly limited to the western section of the county inside Point Reyes National Seashore (Fifield et al. 2015). North Coast (NC) mountain lions in Marin County are separated from the smaller CC-N population by expansive development and the road and freeway network in the greater San Francisco Bay area.

3. Conclusion

The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition discussed information on distribution of the mountain lion and cited published and unpublished studies and reports that indicate a reduction in distribution.

D. Abundance

1. Scientific Information in the Petition

The Petition discusses abundance on pages 34 through 40, and cites Mansfield and Weaver (1989), discussed below. Mountain lions are secretive, making abundance or population trend estimates difficult. Additionally, mountain lion population densities are generally low, which may be driven by prey density, competition between males for access to females, and mutual avoidance (Pierce and Bleich 2003). Other factors contribute to lion abundance, such as habitat quality and quantity, unnatural mortality events due to vehicle strikes and depredation take, and the presence of transient mountain lions within established home ranges of resident lions.

The Petition presents information regarding population densities. In the United States, population densities for mountain lions range from 0.4 to 4.3 resident adults per 38.6 miles^2 (100 km^2), and 0.4 to 7.1 total mountain lions per 38.6 miles^2 (100 km^2), though it varies by population and the presence of human-induced pressures (e.g., hunting) (Pierce and Bleich 2003). In California, where hunting is no longer legal, but other anthropogenic pressures such as roads and development are present, resident adult and total population densities have been found to be 1.1 and 3.6 per 38.6 miles^2 (100 km^2), respectively (Pierce and Bleich 2003).

The Petition noted past efforts by the Department to estimate mountain lion abundance/population size and included the various estimates reported in Mansfield and Weaver (1989). The Petition correctly stated that the Department acknowledges the estimate from 1984 is outdated and relied on density estimates from regional studies to derive a statewide abundance. The Department's estimates were based on field studies

and information available at the time. The estimates reported in Mansfield and Weaver (1989) are as follows:

- 600 in 1920
- 2,400 in 1972
- 2,400-3,000 in 1982
- 4,100-5,700 in 1984
- 5,100 (minimum) in 1988

The 1988 minimum statewide estimate was based on 80,000 square miles of inhabited range. The authors stated the following after presenting these estimates: “However, a statewide population estimate is of limited value. For making management decisions, reasonably accurate population estimates are needed for logical management units”.

The Petition also presents information from the Department’s mountain lion web page (CDFW 2018) which uses a range for a current statewide population estimate of 4,000-6,000 mountain lions. Studies by the Department and other cooperators are in process to update the estimate (Dellinger 2019).

The Petition discusses habitat loss and fragmentation in the Southern California/Central Coast ESU which has negatively affected the abundance of mountain lions. The Petition discusses the six genetic subpopulations in detail and summarizes recent tracking and genetic studies. This information was discussed earlier in the Population Trend section of this Petition Evaluation, given the close relationship between abundance, population size, and population trend.

The Petition notes that new techniques for analyzing wildlife populations through genetic studies are now helping wildlife managers better estimate population size and viability. Because demographic and genetic processes interact, both factors contribute to the probability of extinction for small, isolated populations (Benson et al. 2019).

2. Conclusion

The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition describes what is known about the abundance of mountain lions in the proposed ESU.

E. Life History

1. Scientific Information in the Petition

The Petition addresses life history details of the mountain lion on pages 7 through 21. Information on taxonomy, morphology, population genetics, effective population size

and extinction risk, reproductive biology, foraging ecology and diet, habitat requirements, and survivorship and causes of mortality are discussed. Additionally, the six genetic subpopulations within the proposed ESU are discussed.

As noted earlier in the "Overview of Mountain Lion Ecology" section of this Petition Evaluation, mountain lions have a polygynous social structure and males do not contribute to rearing young. The ratio of adult females to males is 2:1 or 3:1, and sub-adult male lions immigrate further from their natal area than sub-adult female lions (Seidensticker et al. 1973, Beier 1993, Beier and Barrett 1993, Santa Cruz Puma Project 2015). The potential for long distance immigration by young male mountain lions has an important demographic influence if the dispersers become breeders and increase the genetic diversity of a population. Generally, as noted in the Petition, population viability is increased by higher genetic diversity in a population and consistent immigration between small populations is required; however, when barriers to dispersal exist, population viability may become compromised (Riley et al. 2014, Benson et al. 2016, Benson et al. 2019).

The Petition describes how territorial adult mountain lions can be constrained in their movements when faced with barriers such as a large freeway, or a narrow corridor between habitat patches. As an example, in 13 years of study on the SAM population, only one radio-collared male lion crossed I-15, the major freeway barrier between the SAM and the EPR, and that lion was killed 25 days after the crossing for depredating domestic sheep (Vickers et al. 2015). Although Gustafson et al. (2017) documented three males immigrating into the SAM from the EPR, and four males emigrating from the SAM to the EPR over a 15-year period, only one of the males (M86, an immigrant to the SAM) is known to have successfully bred. While M86 improved the SAM population's genetic diversity (Gustafson et al. 2017), high levels of mortalities due to vehicle strikes and depredation/illegal killings likely reduce the number of immigrants that can successfully establish as breeding adults (Vickers et al. 2015).

The Petition cites Beier and Barrett (1993) and Benson et al. (2019) which indicate that in a small population with a female-biased adult sex ratio and high levels of adult mortalities due to vehicle strikes, and 3.4 times more male than female lions affected by depredation take, there is potential for occasional male lion extinction in the SAM, which could severely limit the short- and long-term viability of the population.

The Petition states that the divergence of the genetic subpopulations in the proposed ESU is likely the result of habitat fragmentation caused by roads and development (Ernest et al. 2003, Ernest et al. 2014, Riley et al. 2014, Vickers et al. 2015, Benson et al. 2016, Gustafson et al. 2017, Gustafson et al. 2018, Benson et al. 2019). The six small and nearly isolated populations have an increased risk of inbreeding depression and extinction due to limited genetic exchange. The Petition states habitat connectivity

and habitat protection is needed to help assure viable populations (Ernest et al. 2014, Riley et al. 2014, Vickers et al. 2015, Benson et al. 2016, Gustafson et al. 2018, Benson et al. 2019).

2. Conclusion

The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition presents scientific information on life history of the mountain lion, and the biological, genetic, and habitat factors of concern for the six subpopulations within the proposed ESU.

F. Kind of Habitat Necessary for Survival

1. Scientific Information in the Petition

The Petition addressed mountain lion habitat requirements on pages 19 through 21. As noted in the Petition, mountain lions are primarily solitary and occur in low density. Exceptions to their solitary nature occur in certain situations, e.g., during breeding activities, when females are rearing kittens, or when sub-adults are dispersing with siblings. Mountain lions are territorial and require sufficient cover in order to stalk, ambush, and cache their prey. Because deer are their main prey, a lion population requires sufficient habitat to sustain a deer population and alternate species to prey upon as needed. The Petition describes how large areas of relatively undisturbed habitat with functional connectivity to other suitable habitat areas are needed to allow for successful foraging, resting, breeding, denning, and dispersal. Dispersal includes emigration and immigration (allowing for two-way gene flow), which is essential to maintain exchange of genetic traits between populations, decrease the risk of inbreeding depression, and help assure long term population viability.

As presented in the Petition, mountain lions have large home ranges that may include heterogenous habitats including riparian, chaparral, oak woodlands, coniferous forests, grasslands, and occasionally rocky desert uplands (Grinnell 1914, Grinnell et al. 1937, Williams 1986, Beier and Barrett 1993, Dickson et al. 2005, McClanahan et al. 2017). As a result of their mountain lion study in the SAM population, Dickson and Beier (2002) advised protection of riparian areas from development, road building, and habitat alteration as crucially important to the lion population. They added that habitat adjacent to the riparian zone should also be maintained to help support native prey for mountain lions. Riparian areas provide important stalking and feeding cover for the SAM mountain lion population, and prey kill sites and prey caches were most often associated with this vegetation type (Beier et al. 1995).

Although mountain lions will use moderately disturbed areas as they travel and hunt

(Wilmers et al. 2013, Gray et al. 2016), occupancy is lower in developed areas and lions are more likely to use developed areas if they border open spaces (Wang et al. 2015). Mountain lions require a habitat mosaic that provides sufficient space to move away from human-disturbed areas, and connect to expansive, intact, heterogeneous habitats (Beier 1995, Dickson and Beier 2002, Dickson et al. 2005, Zeller et al. 2017).

Research on mountain lions in the SAM suggested that an area of less than 425 miles^2 (1,100 km^2) was unlikely to support a lion population without some immigration (Beier 1996), and the Santa Monica Mountains (CC-S) are approximately 255 miles^2 (660 km^2). In highly developed areas, the conservation of natural habitat on both sides of freeways and effective corridors across them are needed (Ng et al. 2004), or translocations may be necessary if large carnivores are to persist in proximity to the megacities (metropolitan areas of >10,000,000 people). of the future (Riley et al. 2014).

2. Conclusion

The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition presents scientific information regarding the kind of habitat necessary for the mountain lion's survival, including the importance of functional movement and dispersal corridors between habitat areas, preservation of existing diverse habitat, and adequate buffers from effects of human development, roads, and highways.

G. Factors Affecting the Ability to Survive and Reproduce

1. Scientific Information in the Petition

The Petition discusses factors affecting the mountain lion's ability to survive and reproduce on pages 40 through 53. These factors include low genetic diversity and inbreeding depression, vehicle strikes, depredation and illegal take, mortality from intraspecific strife (i.e., aggression between lions), orphaned kittens and kitten abandonment, poisoning from rodenticides and other environmental toxicants, increased human-caused wildfires, and climate change. Further, the Petition summarizes the primary threats to population viability of mountain lions in the proposed ESU as the direct impacts of past and present habitat modification and destruction. These factors, as described in the Petition, are briefly summarized below.

Most factors affecting the ability of mountain lions to survive and reproduce in the proposed ESU are caused by humans. Lack of adequate habitat and functional connectivity between the mountain lion subpopulations is the primary driver of declining

mountain lion populations. Habitat loss and fragmentation due to development, roads, and highways has resulted in low effective population size, low genetic diversity, extreme levels of isolation, and high mortality rates, which collectively drive the genetic subpopulations within the proposed ESU toward extinction. Ongoing and future planned development in suitable mountain lion habitat further threatens the subpopulations.

As described earlier in the Population Trend section, the Petitioners noted that the CC-N, CC-S, SGSB, and SAM populations are found to have low genetic diversity, and the SAM population's genetic variation is nearly as low as the endangered Florida panther population (Ernest et al. 2014, Riley et al. 2014, Gustafson et al. 2017). Additionally, effective population sizes of the CC-N, CC-S, SGSB, SAM, and EPR populations are well below the older and less conservative scientific threshold of 50, and the CC-C effective population size is just barely above that threshold at Ne = 56.6 (Ernest et al. 2014, Riley et al. 2014, Benson et al. 2016, Gustafson et al. 2018, Benson et al. 2019). These low effective population sizes suggest inbreeding depression could occur within the short-term (over the duration of five generations) and these populations are at increased risk of extinction.

Vehicle strikes are a known mortality factor for mountain lions, and in California, an estimated 100 mountain lions are killed every year by vehicle strikes (Pollard 2016). From 1981 to 2013, vehicle strikes accounted for 53% (50/94) of mountain lion deaths in the SAM, and 30% in the EPR (46/154) (Vickers et al. 2015). Although the CC-N population is less studied, the Petition noted evidence that vehicle strikes are a significant cause of mortalities in this population. At least six mountain lions have been killed by vehicle strikes on Highway 17 in the Santa Cruz Mountains between 2008 and 2018 (Midpeninsula Regional Open Space 2017, Slade 2018) and news outlets reported at least three vehicle strikes killing mountain lions on the I-280 in San Mateo County between 2014 and 2016.

Another factor identified by the Petition to affect mountain lion survival and reproduction is depredation take. Depredation take results in more deaths of male lions compared to females. Statewide, of mountain lions killed for depredation in 2017, 68% were males (CDFW 2018b), and from 1981 to 2013, 3.4 times more male than female mountain lions were killed for depredation purposes in the SAM and EPR (Vickers et al. 2015). Not only do lions killed via depredation permits diminish the total abundance of lions in these populations, but because they consist predominantly of males, the number of primary gene dispersers is also greatly reduced, which further inhibits adequate gene flow (Vickers et al. 2017).

In addition to the reported depredation take, additional mountain lions are illegally killed, and many incidents likely go undocumented (Beier and Barrett 1993, Vickers et al. 2015). Illegal take has been observed in the CC-S, SAM, and EPR (Beier and Barrett

1993, Riley et al. 2014, Vickers et al. 2015) as well as in the CC-N (Yap 2018, pers. observation); and although 80 mountain lions were reported as being killed under depredation permits in 2017, 89 deaths were being investigated (CDFW 2018b).

The Petition describes intraspecific strife as another factor affecting mountain lion populations and the leading cause of mortality for the nearly isolated mountain lions in the Santa Monica Mountains (CC-S) (Riley et al. 2014). Although intraspecific strife is a common source of mortality in mountain lion populations (Beier and Barrett 1993, Logan and Sweanor 2001, Allen 2014), unusually high levels of intraspecific strife have been observed in the CC-S population (Riley et al. 2014). About 41% (9/22) of deaths in radio-collared mountain lions being tracked from 2002 to 2018 were from intraspecific strife, with multiple cases of aggressive adult males killing their siblings, offspring (male and female), and previous mates (Riley et al. 2014). While males are likely to have larger home ranges to protect food resources and access to females, killing of potential mates has no apparent evolutionary benefit, as it reduces chances of future reproduction (Riley et al. 2014). These high levels of intraspecific strife are likely due to limited space in the Santa Monica Mountains caused by dispersal barriers (Riley et al. 2014, Benson et al. 2019).

In the SAM lion population, intraspecific strife was documented on two occasions (one GPS-collared, one previously GPS-collared) since the publication of Vickers et al. (2015), (W. Vickers unpublished data). Enhanced connectivity between populations would facilitate dispersal which would probably reduce and/or prevent high levels of intraspecific strife and improve survival and reproduction rates (Riley et al. 2014, Benson et al. 2019).

The Petition describes mortality of mountain lion kittens (also known as cubs) due to abandonment by their mother, and notes it is fairly common in the Santa Monica Mountains (CC-S), accounting for 23% (5/22) of the known causes of death for marked/collared animals. Mountain lion kittens can also become orphaned if their mother is killed by vehicle strikes or under depredation permit before they have dispersed. If they are too young to fend for themselves, they likely starve to death or are preyed upon by other predators. If the cubs are more mobile, they may approach areas where they are more likely to encounter humans as they search for food. This was seen in November 2017, when a mother mountain lion was killed by a vehicle strike in the SAM and two of her cubs were found roaming near human establishments – one in a backyard and the other along a road (Veklerov 2018). Both cubs, too young to survive on their own, were placed in the Oakland Zoo.

The Petition discusses the emergence of anticoagulant rodenticide (AR) poisoning as a mortality factor for mountain lions in the proposed ESU. These toxicants are used to suppress pest populations in agricultural or urban settings. The potential for direct and

secondary exposure and illicit use of ARs has led to a relatively recent field of study for determining effects of AR poisoning on various carnivore species (McMillin et al. 2008, Gabriel et al. 2012, Serieys et al. 2015), including mountain lions (Riley et al. 2007, Rudd et al. 2018, Rudd et al. 2019).

In southern California, high levels of ARs in bobcats correlated with notoedric mange fatalities causing a local decline in the population (Riley et al. 2007, Serieys et al. 2015). Notoedric manage is caused by a parasitic mite and has been observed in mountain lions (Uzal et al. 2003, Riley et al. 2007, Serieys et al. 2015).

As summarized in Serieys et al. (2015), ARs interrupt the production of vitamin K-dependent blood clotting proteins, leading to the depletion of these proteins over a period of days inducing mortality by internal hemorrhage. Comprised of two classes of compounds, ARs are the primary chemical method used worldwide for the control of rats and mice. First-generation ARs (FGARs), including warfarin, diphacinone, and chlorophacinone, are more readily metabolized, have a shorter half-life in hepatic tissue (2 weeks to several months), and must be consumed in multiple feedings to reach a lethal dose. Second-generation ARs (SGARs) include brodifacoum, bromadiolone, and difethialone, and were developed to target rodents with genetic resistance to warfarin. Due to prolonged action and increased potency with hepatic half-lives ranging from 6-12 months, SGARs may persist in liver tissue for more than a year in some species. Both classes of compounds have delayed onset of action, and death from AR consumption can occur up to 10 days after ingestion. Individual rodents may continue to accumulate the compounds over a period of days, increasing their attractiveness to predators as they become weakened by the toxicant, and easier to capture. Mountain lions become poisoned by ingesting the contaminated rodents, or by eating prey species that have ingested contaminated rodents.

The Petition discusses the Department's Wildlife Investigations Lab (WIL) studies of AR exposure in necropsied mountain lions since 2016. Results of WIL's recent analyses found AR exposure in 241 of the 252 (95.6%) of mountain lion livers tested from 2016 to 2018 (Rudd et al. 2019). SGARs were more commonly detected than FGARs, despite a 2014 regulatory change restricting SGAR use to certified pesticide applicators. Past and ongoing work by WIL demonstrates widespread exposure to both FGARs and SGARs in California's mountain lions. However, during the two-year study, mortalities related to AR poisoning were not observed on postmortem examination and no consistent occurrence of a disease process compatible with immunosuppression was observed (Rudd et al. 2018, Rudd et al. 2019, Rudd unpublished data).

Conversely, in 2004 a study in the CC-S subpopulation documented two adult mountain lions that died directly from anticoagulant toxicity, and both lions also had infestations of notoedric mange (Uzal et al. 2003, Riley et al. 2007). Two other mountain lions that died

in intraspecific fights also exhibited exposure to two to four different anticoagulants. These results indicate AR toxicity can have direct and possibly indirect effects on mortality (Riley et al. 2007). The Petition notes that in the SAM subpopulation, anticoagulant rodenticide residues were detected in the livers of 100% of deceased animals tested, with up to five different compounds detected in some animals (Riley et al. 2007, Riley et al. 2014, W. Vickers, pers comm).

The Petition also notes exposure of mountain lions to dangerously high levels of illegal pesticides, such as carbofuran, used on illegal marijuana grow sites, which, like ARs, can also bioaccumulate in the liver and potentially cause health issues (Rudd et al. 2019). Further research is needed to investigate the lethal and sub-lethal effects of anticoagulants and other toxicants on wildlife in terrestrial environments (Riley et al. 2007, Gabriel et al. 2015, Rudd et al. 2018).

As noted in the Overview of Mountain Lion Ecology section of this Petition Evaluation, the fisher (*Pekania pennanti*) is a forest carnivore and known prey species for mountain lions in some forested areas of California (Wengert et al. 2014), including the southern geographic region of the WSN subpopulation of lions. Fisher have been documented to suffer mortality from AR exposure, and researchers concluded that mortality from and exposure to toxicants appears to be on the rise, and exposure to multiple ARs increases probability of death (Gabriel et al. 2015).

The Petition describes increased frequency of wildfire as another factor affecting mountain lion survival. Although fire is a natural disturbance in California ecosystems, sprawl development with low/intermediate densities extending into habitats prone to fire have led to more frequent wildfires that burn larger areas (Syphard et al. 2007, Syphard et al. 2009). Most wildfires in California are caused by human ignitions, like power lines, arson, improperly disposed cigarette butts, debris burning, fireworks, campfires, or sparks from cars or equipment (Keeley and Fotheringham 2003, Syphard et al. 2007, Syphard et al. 2012, Bistinas et al. 2013, Balch et al. 2017, Radeloff et al. 2018, Syphard et al. 2019). The Petition noted that although mountain lions are highly mobile and generally able to move away from wildfires, in severe weather conditions wind-driven fires can spread quickly (Syphard et al. 2011). If mountain lion movement is constrained by roads and development, and the lions are unable to access escape routes, their chances of surviving wildfires are greatly reduced. Vickers et al. (2015) documented one death of a collared mountain lion in the SAM and one in the EPR due to human-caused wildfires, and the deaths of two collared mountain lions in the CC-S in 2018 have been attributed to the Woolsey Fire. Additionally, increased frequency of fire ignitions can cause shifts in natural fire regimes, potentially leading to large-scale landscape changes, such as vegetation-type conversion and habitat fragmentation, which can impact wide-ranging species like the mountain lion (Jennings et al. 2016).

The Petition also discusses climate change as a factor affecting mountain lion survival and reproduction, and briefly summarizes the scientific consensus on climate change, citing some relevant scientific papers, e.g., Warren et al. (2011) and Wiens (2016). Improving landscape connectivity is a key factor for climate change resilience and adaptation (Heller and Zavaleta 2009), and this holds true for a wide-ranging carnivore like the mountain lion. Without functional connectivity that provides multiple pathways for mountain lion movement, the Central Coast and Southern California mountain lion populations and the prey they depend on may not be able to shift their ranges as available resources shift in response to climate change. Enhanced connectivity that provides multiple corridors for safe passage between suitable habitat areas would improve chances of survival and reproduction by increasing the probability of movement across landscapes by a wider variety of species, and providing alternate escape routes or refugia for animals seeking safety from catastrophic wildfires (Mcrae et al. 2008, Pinto and Keitt 2008, Mcrae et al. 2012, Cushman et al. 2013, Olson and Burnett 2013).

2. Other Relevant Scientific Information

In addition to the limiting factors described above, some diseases contribute to mountain lion mortality, though they are not common at this time. The three diseases reported for mountain lions that were not included in the Petition are described below.

1. Feline infectious peritonitis (FIP) is a fatal immune-mediated vasculitis of felids caused by a mutant form of a common feline enteric virus, feline enteric coronavirus. The virus can attack many organ systems and causes a broad range of signs, commonly including weight loss and fever. Regardless of presentation, FIP is ultimately fatal and often presents a diagnostic challenge. In May 2010, a malnourished young adult male mountain lion (Puma concolor) from Kern County, California, USA was euthanized because of unusual behavior and concern for public safety. A postmortem examination was performed, and a PCR for coronavirus performed on kidney tissue was positive, confirming a diagnosis of FIP. Although coronavirus infection has been documented in mountain lions by serology, this was the first confirmed report of an FIP-related mortality (Stephenson et al. 2013).

2. Feline leukemia virus (FeLV): A young adult male free-ranging mountain lion was removed from a college campus in Sacramento, California, and blood samples taken shortly after capture revealed it to be anemic, lymphopenic, suffering from renal disease, and feline leukemia virus (FeLV) antibody positive (Jessup et al. 1993). The researchers noted that as human populations expand into and utilize wildlife habitats, free-ranging wild animals may come into contact with diseases most commonly associated with domestic animals. Feline leukemia virus (FeLV)

infection had not previously been reported in free-ranging wild felids in North America. FeLV infection is horizontally and vertically transmitted by body fluids, particularly through saliva. In general, transmission of viruses can occur through two pathways: horizontal and vertical transmission. In horizontal transmission, viruses are transmitted among individuals of the same generation, while vertical transmission occurs from mothers to their offspring. Generally, direct contact between cats is required for effective transmission. Although the origin of the cougar's FeLV infection is a matter of speculation, contact with and consumption of domestic cats, particularly feral domestic cats in urban neighborhoods or along the riparian corridor, may have been the source of this animal's FeLV infection.

3. In California, two cases of mountains lions with rabies are known:

    a) On July 5,1909, along Coyote Creek, near Morgan Hill, in Santa Clara County, a young boy and an adult woman were attacked by a mountain lion. Both victims died, and the physician for the woman determined she died of hydrophobia (Storer 1923).

    b) In August 1994, two couples staying at a remote Mendocino County cabin reported killing a mountain lion after it charged them. Tests indicated the mountain lion was rabid (CDFG 2000).

    3. Conclusion

The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition discusses results of numerous scientific studies that describe multiple factors affecting the ability of mountain lions to survive and reproduce within the proposed ESU. The direct impacts of past and present habitat modification and destruction combine to threaten the population viability of mountain lions in the proposed ESU

H. <u>Degree and Immediacy of Threat</u>

    1. Scientific Information in the Petition

The Petition discusses the degree and immediacy of threats to mountain lions on pages 53 through 54. As discussed in Section G of this Petition Evaluation, the petition contains sufficient information indicating that habitat loss, habitat fragmentation, and lack of habitat connectivity have led to small, isolated genetic subpopulations of mountain lions with evidence of inbreeding and a lack of adequate gene flow between them. Mountain lions also face human-caused mortality factors from vehicle strikes,

depredation take, poaching, take associated with public safety incidents, and anticoagulant rodenticides, along with the added stressors of increased wildfire risk and vegetation-type conversions that are not likely to favor mountain lions (Jennings et al. 2016). It is important to consider the cumulative effects of these factors in combination with the overarching future effects of climate change, and the ongoing and future planned development in suitable mountain lion habitat.

The Petition describes how roads and development have fractured habitat connectivity for mountain lions in the proposed ESU, leading to the separation of at least six isolated, genetically distinct populations. Benson et al. (2019) predicted loss of genetic heterozygosity in the SAM and CC-S mountain lion populations, which suggests that inbreeding depression is imminent. If inbreeding depression occurs, these two populations will likely go extinct within 50 years, with median times to extinction of 11.7 years and 15.1 years, respectively (Benson et al. 2019). The Petition states the similarly low genetic diversity and effective population size of the SGSB, and CC-N populations will likely result in a similar fate. And, although the CC-C and EPR populations appear slightly healthier with more genetic diversity and a higher effective population size, the effective population sizes of these populations are still well below the most recent recommended threshold to prevent inbreeding depression in the short-term (Frankham et al. 2014, Gustafson et al. 2018).

The Petition states immediate action is needed to protect areas of existing connectivity, and to restore connectivity between the subpopulations. Anthropogenic pressures, especially vehicle strikes, and depredation take, should be minimized to help recover these populations. For the federally endangered Florida panther, translocation of mountain lions from Texas to Florida helped to increase genetic diversity, but researchers have noted that continued habitat loss, persistent inbreeding, infectious agents, and possible habitat saturation pose new dilemmas. They stated that the intensive management program illustrates the challenges of maintaining populations of large predators worldwide (Johnson et al. 2010).

The Petition describes how sustaining recovery programs, such as that for the Florida panther, requires predictable long-term funding, and conservation of habitat before costs escalate or it is lost. In California, any similar potential genetic rescue/translocation efforts need to be compared to the potential value of strategically located corridors and wildlife crossing infrastructure that allows for dispersal and gene flow, along with a reduction in vehicle-strike mortalities. The Petition states that this latter habitat enhancement emphasis would be a more comprehensive, long-term solution to conserve the mountain lion populations within the proposed ESU in perpetuity. The Petition further emphasized that the preservation of intact linkages, especially the Tehachapi and Sierra Pelona Mountains, is essential to maintain statewide genetic connectivity of mountain lions (Gustafson et al. 2018).

2. Conclusion

The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition presents scientific information describing multiple threats to the continued existence of mountain lions in the proposed ESU. The Petition concludes that two demographic threats of small effective population sizes and loss of genetic diversity are severe and require immediate attention.

I. Impact of Existing Management Efforts

1. Scientific Information in the Petition

The Petition discussed the impact of existing management efforts on pages 54 through 69, under the “Inadequacy of Existing Regulatory Mechanisms” section.

The Petition noted the following in regard to an inadequacy of the California Environmental Quality Act (Pub. Resources Code, § 21000 et seq.) (CEQA): Even when a lead agency acknowledges that an effect is “significant,” CEQA allows a lead agency to adopt a “statement of overriding considerations” and approve a project if the agency finds that other factors outweigh the environmental costs of the project or that further mitigation is infeasible (Pub. Resources Code, § 21081; Cal. Code Regs., tit. 14, § 15093(b)); Cal. Pub. Res. Code § 21081). The Petition further noted that even if a project may have a significant effect on a “wildlife population” like the CC-S, SAM, SGSB, or EPR mountain lions, an agency could interpret CEQA as still allowing approval of the project. Therefore, the Petitioners conclude that CEQA, in practice, is inadequate to protect the Southern California and Central Coast mountain lions.

Further, the Petition describes how the Northwest Highway 138 EIR contained no analysis of the highway’s impacts on mountain lions, given that they are not presently listed as threatened or endangered. Though the Department has urged lead agencies to consider wildlife connectivity in CEQA planning documents, Los Angeles County’s responses to CDFW’s recommendations indicate that lead agencies have not interpreted CEQA to include a clear legal mechanism for mitigation for impacts on wildlife connectivity, even though such connectivity is critical to the survival of Southern California and Central Coast mountain lions.

The Petition describes multiple projects and human population growth with associated housing developments, and road and highway expansions that could impact mountain lion habitat and movement corridors and contribute to mortality due to vehicle strikes. Planning document inadequacies are also described. Some examples, described in the Petition, are summarized below.

Natural Community Conservation Planning Act (NCCP), and Habitat Conservation Plans (HCPs)

The San Diego Multiple Species Habitat Conservation Program is a joint NCCP and HCP that includes mountain lions as a covered species, but the program readily concedes that mountain lions (as well as deer) "were not a major consideration in linkage design." In addition, the joint Environmental Impact Report/Environmental Impact Statement (EIR/EIS) states that "[d]ue to the limited availability of habitat in the study area, implementation of the MSHCP is not expected to substantially increase or decrease the population viability of the mountain lion." The EIR/EIS likewise concludes no major populations or critical locations exist for the mountain lion within the plan area and concludes the species is "adequately conserved" under the plan.

The San Diego Multiple Species Conservation Program is an NCCP and HCP that covers 900 square miles in the southwestern portion of San Diego County. The Program lists mountain lions as "conserved" and states that mountain lions "will be covered by the MSCP because 81% of the core areas (105,000± acres) that support its habitat will be conserved". While the Program generally notes linkage, areas were designed to accommodate "large animal movement," the Program does not identify linkages designed for mountain lions or specific measures designed to protect them. Likewise, while the Program states that "[s]pecific design criteria for linkages and road crossings/under crossings are included in subarea plans," not all subarea plans are complete. The San Diego North County Multiple Species Conservation Plan is one of the "sub-area" plans anticipated under the San Diego Multiple Species Conservation Program. However, it has not been completed and is still in development.

The Orange County Transportation Authority NCCP/HCP ("OCTA Plan") lists the mountain lion as a covered species for purposes of the federal HCP, but not for purposes of the NCCP permit. The OCTA Plan contains four "Species Goals" for mountain lions, including (1) acquiring 1,013 acres of suitable habitat; (2) realigning fencing near the Highway 241 toll road; (3) funding of the North Coal Canyon Restoration Project; and (4) a "wildlife crossing policy" requiring pre-construction surveys to ensure existing crossings "maintain or improve functionality" if modified by new freeway projects. However, despite allowing the expansion of two highways in mountain lion habitat (Projects G and J), the OCTA Plan does not require the construction of specific wildlife crossings. The OCTA Plan nonetheless claims that impacts on the mountain lion will be offset through these "Species Goals."

A Western Riverside County Multiple Species HCP offers little protection for the SAM mountain lion population. While this HCP identifies linkages designed to ensure connectivity for mountain lions, the Western Riverside County Regional Conservation Authority has failed to enforce the HCP to protect such linkages when permittees such

as the City of Temecula approve development that would severely constrict or impair such linkages.

A Santa Monica Mountains National Recreation Area General Management Plan ("GMP") was prepared pursuant to NEPA and provides a framework for the management of the Santa Monica Mountains National Recreation Area ("SMMNRA"), administered by the National Park Service, California State Parks, and the Santa Monica Mountains Conservancy. The GMP recognizes that the Santa Monica Mountains mountain lion population's ability to survive in the face of large-scale habitat fragmentation and destruction is uncertain. The GMP states, "it is likely that their persistence would depend upon their capability of dispersing to and from other habitat areas beyond the Santa Monica Mountains." The GMP concedes, "the situation is especially serious for mountain lions" and lists mountain lions as a "park species of concern." The GMP agrees that improvements to facilitate wildlife movement across freeways or through developments may be necessary but does not propose or require specific actions to improve wildlife movement across freeways or through development.

A Ventura County Wildlife Connectivity Ordinance was adopted by the Ventura County Board of Supervisors on March 12, 2019 (the "Connectivity Ordinance") to help facilitate wildlife connectivity and minimize habitat fragmentation for mountain lions, mule deer, California gnatcatchers, bobcats, least bell's vireos, California red-legged frogs, and other species. Two of the linkages targeted in the Connectivity Ordinance are the Santa Monica Mountains – Sierra Madre Mountains connection and the Sierra Madre Mountains – Castaic Connection, which connect wildlife habitat in the Santa Monica Mountains, Santa Susana Mountains, Simi Hills, and Los Padres National Forest. While the Connectivity Ordinance should help allow wildlife to move more easily through private lands between core habitat areas, it would do little to ensure connectivity across major roads and highways because Ventura County does not have jurisdiction over these areas. The Petition also states that Caltrans and its road maintenance and improvement activities are not regulated by the Connectivity Ordinance.

A Los Angeles County Significant Ecological Areas Program is currently in the process of updating its Significant Ecological Areas ("SEAs") Ordinance. The draft ordinance is intended to protect biodiversity in SEAs from incompatible development and ensure that projects reduce habitat fragmentation and edge effects by providing technical review of impacts and requiring mitigation. Like the Ventura County ordinance, the SEAs designations can lead to compact development and allow wildlife to more easily move across private lands between core habitat areas. However, the SEA ordinance is not specifically designed to protect mountain lions and would not regulate Caltrans and its road maintenance and expansion activities.

In an environmental review for Southern California national forest land management plans, the U.S. Forest Service found impaired connectivity poses a serious threat to Southern California mountain lions: the "greatest concern for the long-term health of mountain lion populations on the national forests of southern California is loss of landscape connectivity between mountain ranges and large blocks of open space on private land." The review warned that private land development in Southern California is "steadily reducing the habitat linkages that wildlife species need to connect large blocks of national forest land with other public and private natural spaces and habitat reserves."

The Petition notes that there are currently no NCCPs that cover the Central Coast. In addition, no NCCPs cover portions of the Santa Cruz Mountains, except the Santa Clara Valley Habitat Plan; however, that Plan does not cover mountain lions.

Growth is expected to increase in the Monterey Bay Area, leading to further fragmentation of natural habitats by urban or exurban development. The Association of Monterey Bay Area Governments predicts the population in the Monterey Bay Area to rise from 755,403 in 2015 to 883,300 in 2040. In San Luis Obispo County, the population is expected to increase by 41,650 between 2015 and 2045.

The Petition describes numerous other road and highway expansion projects planned for Santa Cruz, Monterey, San Luis Obispo, and Santa Barbara counties. The expansion of existing roads and highways along with increased numbers of automobiles could further impair habitat connectivity for mountain lions in the Central Coast region.

California Wildlife Protection Act of 1990 (Proposition 117) and CESA

The Petition asserts that CESA listing would build upon protections established by Proposition 117 (Fish & G. Code, §§ 4800-4810) by establishing an affirmative duty to ensure the survival and recovery of Southern California and Central Coast mountain lions by, among other things: (1) prohibiting the approval of projects that could jeopardize the continued existence of mountain lions or result in destruction of essential habitat pursuant to Fish and Game Code section 2053, subdivision (a); (2) requiring state agencies such as Caltrans to utilize their authority to conserve listed species pursuant to section 2055); and (3) requiring implementation of appropriate mitigation measures for projects that could destroy mountain lion habitat or impair connectivity pursuant to section 2054. Also consistent with Proposition 117, the Petition notes that section 2052 establishes that it is the policy of the state to conserve and protect listed species and their habitat, including through acquiring lands.

Regarding the different provisions in Proposition 117 and CESA, the Petition states that Proposition 117 is to be "liberally construed to further its purposes." (Prop. 117 § 9); it

also states that because Proposition 117 and CESA both have similar purposes; Proposition 117 should be construed to be consistent with CESA.

2. Conclusion

The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition presents information to indicate existing regulatory mechanisms and conservation efforts do not adequately protect mountain lions within the proposed ESU from impacts that threaten their long-term survival. In particular, as stated in the Petition and cited in scientific reports, land use planning and permanent protection of habitat needs to occur at a larger scale across jurisdictional boundaries, and include multiple functional habitat connections/corridors to allow safe movement by mountain lions and their prey, while also lessening the human-caused mortality factor of vehicle strikes.

J. Suggestions for Future Management

1. Scientific Information in the Petition

The Petition suggests future management on pages 70 through 72. The ten suggestions focus primarily on essential habitat conservation and connectivity. They are included here in their entirety for easy reference and to compare to other relevant scientific information provided in subsection J.2. below.

1. Design and build crossing infrastructure in strategic locations to improve wildlife connectivity and permeability at existing roads and highways. Crossing infrastructure should include but is not limited to overcrossings, underpasses, culverts, and exclusionary fencing that guides animals to safer crossing areas. The following crossing locations have been identified by mountain lion experts and should be prioritized for the implementation of crossing infrastructure: 1) I-15 Freeway at Temecula Creek Bridge to enhance the Palomar Linkage and connect the Santa Ana and Eastern Peninsular Mountain Ranges (Gustafson et al. 2017, Zeller et al. 2017, Ernest et al. 2014, Riley et al. 2018); 2) I-15 Freeway at “Site 5” as described in Riley et al. (2018); 3) Hwy 101 at West Liberty Canyon (Riley et al. 2018.)

2. Improve or add large culverts to existing freeways in areas suitable for mountain lion crossing (Vickers [et al.] 2015).

3. Dedicate sufficient Wildlife Conservation Board, Habitat Conservation Fund and other state funding sources towards acquiring key mountain lion habitat and for establishment of highway crossing infrastructure.

4. Ensure that suitable habitat exists (through preservation or restoration/enhancement) on both sides of crossing structures and culverts (South Coast Wildlands 2008). Restrict human activity near crossing structures and relocate foot trails away from these structures (South Coast Wildlands 2008).

5. Fully protect mountain lion habitat, including resource-use patches and corridors (Zeller et al. 2017, Vickers et al. 2015). Prohibit large-scale development in primary travel corridors and habitat linkages, such as in and around the last remaining linkage for statewide genetic connectivity in the Tehachapi and Sierra Pelona Mountains (Gustafson et al. 2018) and in corridor areas between the SAM and EPR (Gustafson et al. 2017).

6. Require analysis of region-wide wildlife connectivity in all new development proposals (Gustafson et al. 2018).

7. Reduce depredation conflicts that precipitate mountain lion deaths (Vickers et al. 2015). Develop and implement outreach and education activities to promote use of predator-proof enclosures for domestic animals (Vickers et al. 2015). Expand CDFW's new three-step depredation permit policy in the CC-S and SAM areas to include all mountain lions across the state, or at a minimum, within the SGSB, EPR, CC-N, and CC-C population areas. Enhance the policy with enforceable implementation of non-lethal protective measures and reporting requirements.

8. Prohibit the use of second-generation anticoagulant rodenticides ("SGARs"), such as brodifacoum, bromadiolone, difenacoum, and difethialone in Southern California and Central Coast mountain lions' core habitat areas and linkages. Limit the use of other pesticides and herbicides that may have negative effects on mountain lion populations in Southern California and the Central Coast.

9. Identify "priority areas" for establishing wildlife passage features for the Southern California and Central Coast mountain lions using the best available science, including data collected by various agencies, academic institutions, and organizations, including but not limited to the National Park Service, the Karen C. Drayer Wildlife Health Center at UC Davis, the Road Ecology Center at UC Davis, and the Santa Cruz Puma Project at UC Santa Cruz.

10. Require Caltrans to analyze how projects in the State Highway Operation Protection Program and State Transportation Improvement Program can be designed to facilitate wildlife connectivity through wildlife passage features such as culverts, under crossings, overcrossings, bridges, directional fencing,

scuppers, barrier breaks, roadside animal detection systems, etc. Require Caltrans to collect and analyze roadkill data to identify hotspots where mountain lions are killed. Require Caltrans to implement wildlife passage features to the greatest extent feasible and as expeditiously as possible.

2. Other Relevant Scientific Information

The Department is aware of policies and guidelines and other suggestions for future management of mountain lions, as noted below.

a. Monitor responses to increasing fire frequency to assess how mountain lions and other carnivores will be affected by large-scale changes that may pose a threat to landscape integrity and persistence of puma populations in southern California (Jennings et al. 2016).

b. Maintain viable mountain lion populations within California; and provide for flexibility in controlling depredation problems (Weaver 1982).

c. Recommend continued AR screening of livers from mountain lion carcasses to further enhance our understanding about the relative contributions they may have on population health. Continued monitoring would also measure the effectiveness of regulatory changes intended to reduce exposure of non-target wildlife to rodenticides (Rudd et al. 2018).

d. From the Department's Mountain Lion Depredation, Public Safety, and Animal Welfare Bulletin Number 2017-07 (amendment to Department Bulletin 2013-02): Fundamental to the Department's conservation, education, and outreach regarding mountain lions, the Department works to (a) maintain genetically diverse and demographically viable populations, (b) minimize conflicts between mountain lions and humans, (c) identify and protect important habitats, (d) improve public awareness, and (e) identify and research emerging management and scientific issues.

e. From the Fish and Game Commission's "Terrestrial Predator Policy", adopted April 19, 2018: It is the policy and practice of the Fish and Game Commission that: existing native terrestrial predator communities and their habitats are monitored, maintained, restored, and/or enhanced using the best available science. The department shall protect and conserve predator populations.

f. Develop reliable maps of cougar habitat quality and landscape linkages; maps should identify potential corridors for population movement and dispersal.

Evaluate trans-highway movements and vehicle-related mortality of cougars (Cougar Research and Management Needs, Chapter 9, by Ted D. McKinney, in Jenks 2011, CMGWG 2005).

g. Assess and map the status of, and threats to, each subpopulation. Identify linkages, assess the quality of each linkage, and conserve and restore linkages. Provide incentives to landowners to protect habitat. Consider augmentation (translocation and reintroduction) as a last resort alternative to natural connectivity (Chapter 3, Cougar Habitat, in CMGWG 2005).

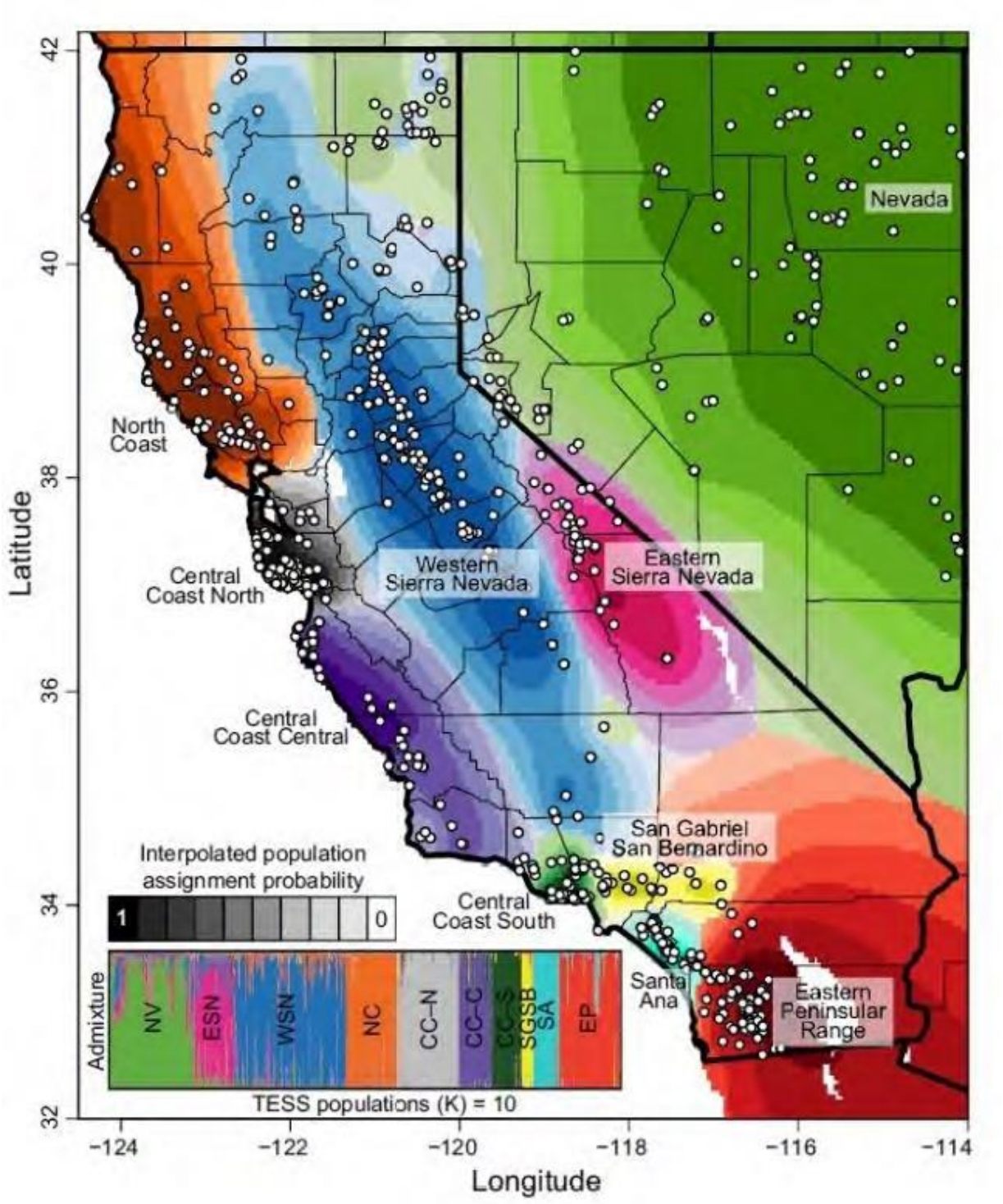
3. Conclusion

The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted. The Petition includes information to indicate future management actions would benefit mountain lion populations in the proposed ESU, e.g., wildlife corridors and crossing structures over or under freeways and major roads. The Petition also cites studies containing a number of suggestions for future management e.g., land use planning at a larger scale to promote optimal habitat connectivity and gene flow, and for conservation of mountain lion prey and other wildlife species.

K. Detailed Distribution Map

1. Scientific Information in the Petition

The Petition provided the following map (Petition Figure 1) showing the genetically distinct mountain lion populations in California and Nevada with each color representing a genetic population. The reduced color intensity on the map represents lower probabilities of population assignment and indicates areas with admixture between mountain lion populations (Gustafson et al. 2018).



Petition Figure 1.
Map of genetically distinct mountain lion populations in California. The Central Coast North (CC-N), Central Coast Central (CC-C), Central Coast South (CC-S), San Gabriel/San Bernardino (SGSB), Santa Ana Mountains (SAM), and Eastern Peninsular Range (EPR) mountain lion populations should be considered an evolutionarily significant unit (ESU). Each color represents a genetically distinct mountain lion population. White dots are individual animals sampled. Source: Gustafson et al. (2018).

2. Other Relevant Scientific Information

Petition Figure 1 generally matches the historical and recent distribution of the mountain lion as described in Grinnell (1914), Grinnell et al. (1937), Young and Goldman (1946), Sitton (1977), Weaver (1982), Williams (1986), Mansfield and Weaver (1989), CDFG (1990), Torres et al. (1996), and Torres and Lupo (2000). A detailed map (Figure 221) from Grinnell et al. (1937) is provided below for comparison purposes and for historical context.

Torres and Lupo (2000) used the distribution of deer (Odocoileus hemionus) as an indicator to define the distribution of mountain lions since deer are a primary prey species; additional records and observations of lions were added to complete the distribution map (Figure 1).

Weaver (1982) produced a statewide distribution map that included relative density estimates for populations of mountain lions in California.

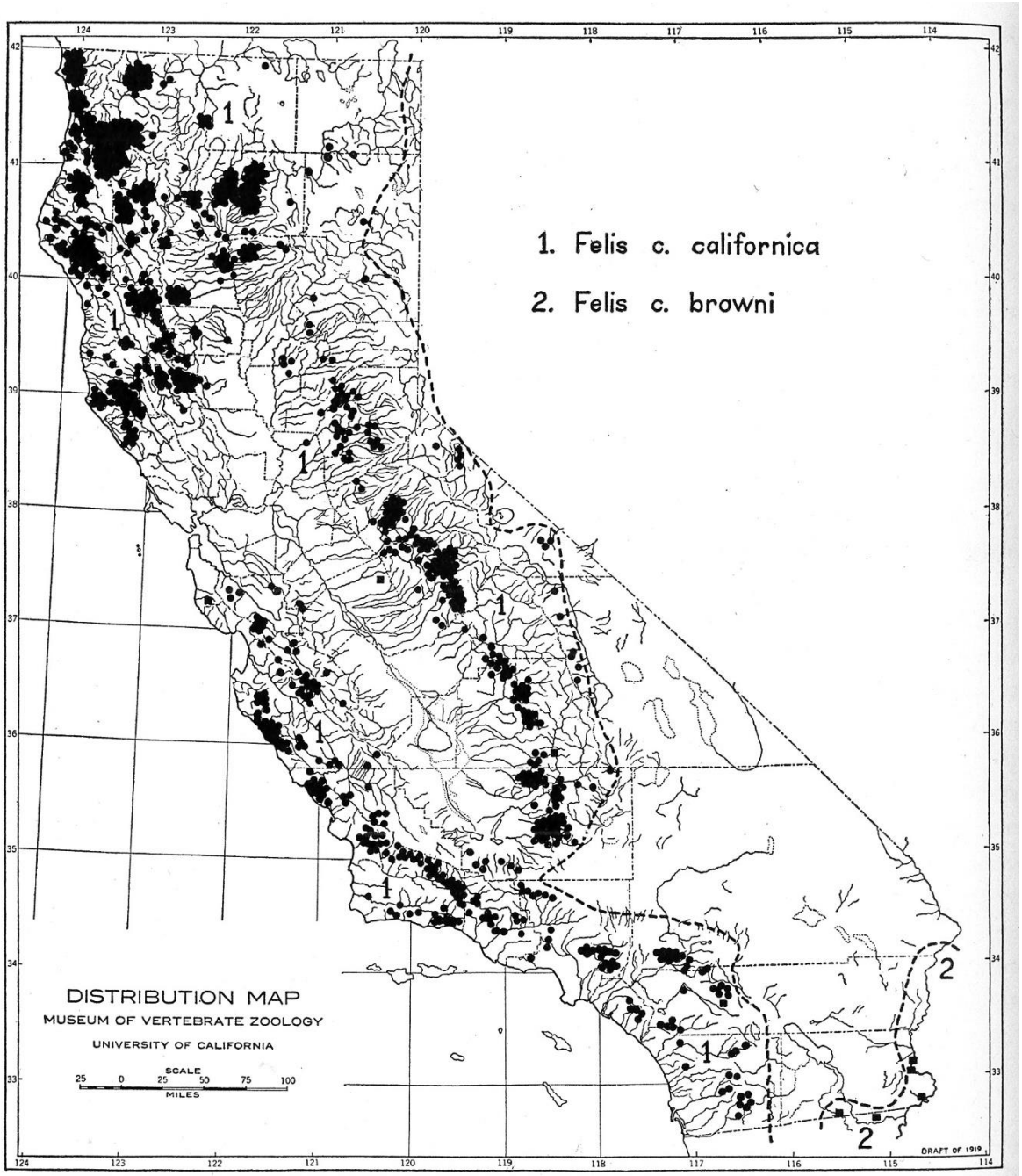


Fig. 221. Distribution of mountain lions in California: Round spots indicate localities of capture as stated in the Fish and Game Commission bounty records for the 7-year period, 1913–1919; square spots indicate some known localities of record otherwise, most of them as represented by specimens preserved. The approximate former limits, in California, of the two races are shown by broken lines; these races are: *1*, California mountain lion; *2*, Yuma mountain lion.

Figure 221. Distribution of mountain lions in California from Grinnell et al. (1937); page 540.

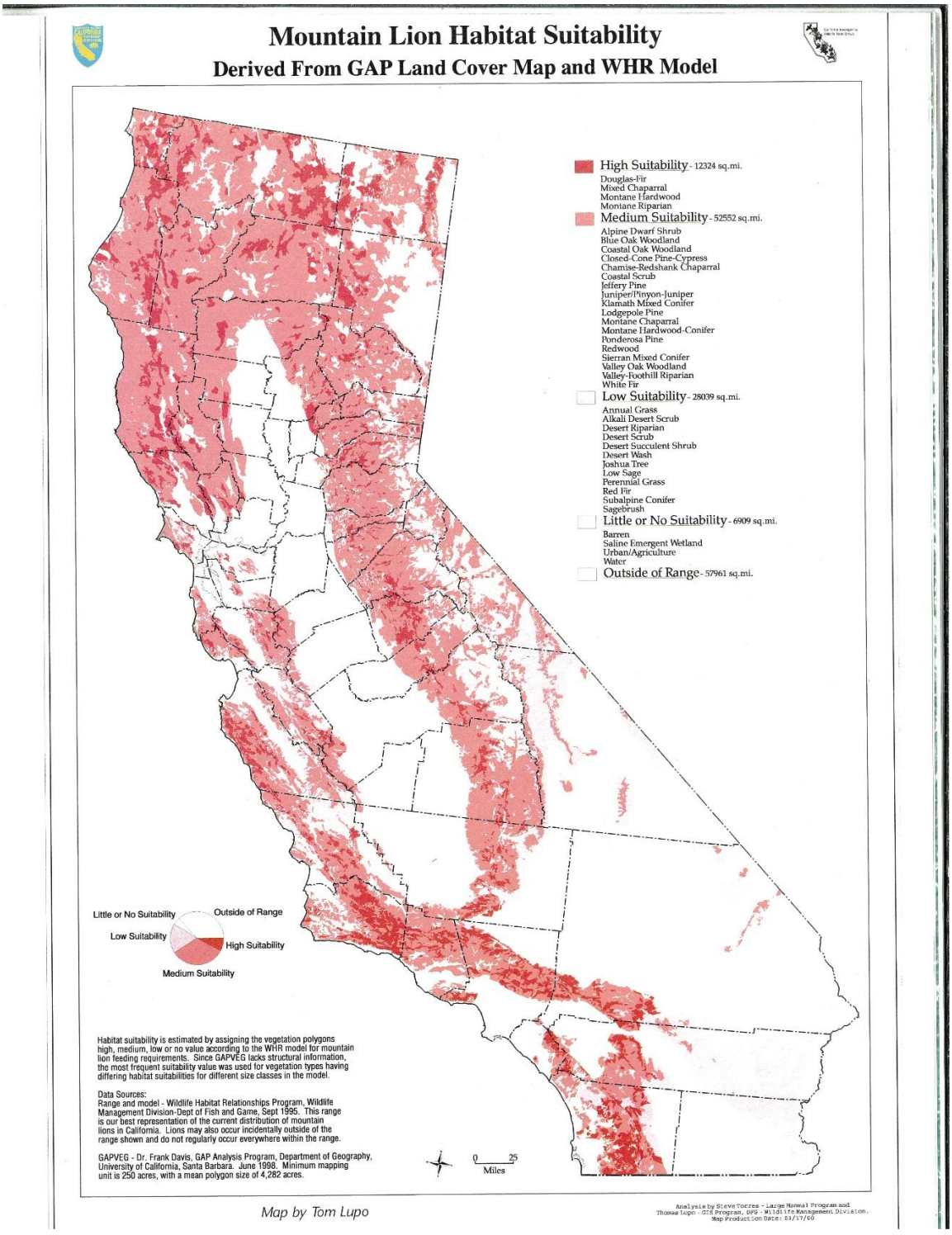


Figure 1. **Mountain Lion Habitat Suitability**. *In* Outdoor California (61) 3:22-23. (Source: Torres and Lupo 2000).

3. Conclusion

The Petition's distribution map (Petition Figure 1) sufficiently illustrates the distribution of genetic subpopulations of mountain lions in California. The Petition included additional maps showing mountain lion distribution in relation to road density, vehicle kill locations, and important landscape features (e.g., key habitat linkages) needed to maintain the distribution and genetic health of mountain lion populations in California (see Figure 3, and Figures 5-9 in the Petition).

L. Sources and Availability of Information

1. Scientific Information in the Petition

The Petition cited more than 140 scientific and administrative documents related to mountain lion biology, ecology, habitat relationships, genetics, and conservation, including geographic and land use factors involved in designating the genetic populations and the Southern California/Central Coast ESU. The Petitioner provided electronic copies of most of these documents.

2. Other Relevant Scientific Information

The Department used additional sources of scientific information cited in this Petition Evaluation document.

3. Conclusion

The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted.

V. Recommendation to the Commission

Having reviewed and evaluated relevant information, including the material referenced in the Petition and other information in the Department's possession, the Department has determined the Petition provides sufficient scientific information to indicate that the petitioned action may be warranted. Therefore, the Department recommends the Commission accept the Petition for further consideration pursuant to Fish and Game Code section 2074.2.

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CALIFORNIA LEGISLATURE

STATE CAPITOL
SACRAMENTO, CALIFORNIA
95814

April 2, 2020

Mr. Erik Sklar, President
California Fish and Game Commission
1416 Ninth Street, Suite 1320
Sacramento, CA 95814

Submitted via email to fgc@fgc.ca.gov

RE: Support Candidacy Status for Southern California and Central Coast Mountain Lions under the California Endangered Species Act

Dear President Sklar and Commissioners:

We, the undersigned members of the California State Legislature, write today with great urgency because California Endangered Species Act (CESA) protections for Southern California and Central Coast Mountain Lions cannot come soon enough. These highly imperiled icons of the Golden State are fast approaching extinction due to habitat loss and fragmentation, genetic isolation, vehicle strikes, rodenticide poisoning, depredation kills, poaching, disease and the increasing impacts of climate change, but it is not too late to save them. CESA protections for mountain lions would improve habitat connectivity, increase conservation management tools, and require crucial planning for species recovery, giving these animals a fighting chance at survival. We strongly recommend the California Fish and Game Commission advance the petition to list all mountain lion populations in the proposed evolutionarily significant unit (ESU) as threatened under CESA, thereby initiating a full status review of the species and providing vital interim protections as a candidate species.

As you know, the loss of the Southern California mountain lion known as P56 last month was a tragedy. He was one of only two known breeding males in the Santa Monica mountains, and a radio-collared member of a long-term National Park Service study. P56's death put the entire population closer to the brink, but his loss will not be in vain if it drives this Administration, the Legislature and the public to work together to develop a comprehensive solution to save our lions from becoming California's latest

contribution to the global biodiversity crisis.[1] Providing CESA protections is an important step in the right direction.

Scientific research demonstrates that California mountain lions are profoundly impacted by human activity, particularly suffering from habitat loss and fragmentation due to roads and poorly sited development projects.[2] Lion populations in the Santa Ana and Santa Monica mountains could disappear within our lifetime from myriad threats that combine to create an "extinction vortex," including habitat destruction, lack of genetic diversity, increasing wildfires, disease and human-caused mortalities.[3] Other populations within the proposed ESU, including those in the Santa Cruz, San Gabriel and San Bernardino Mountains, exhibit similarly concerning patterns.[2]
As apex animals, mountain lions play a critical role in maintaining our state's biodiversity, and are important drivers of ecosystem function, structure and dynamics. Protecting these wide-ranging top predators would benefit a multitude of other sensitive, imperiled and important species by assisting in the maintenance of diverse habitats that support a variety of wildlife. Conserving mountain lions could help galvanize a modern, landscape-scale approach to habitat connectivity in California, while the elimination of these iconic cats could lead to further ecosystem degradation and biodiversity decline.

Protecting mountain lions would also benefit public health and safety. Every year, vehicle strikes kill approximately one hundred mountain lions as they attempt to cross our busy California roadways. Citizens report thousands of additional collisions with other large mammals, primarily deer, to state agencies and insurance companies. Listing mountain lions under CESA would facilitate planning for wildlife crossings that allow safe passage across roads and freeways, not only improving gene flow between isolated lion populations but also ensuring safe passage for many other species and reducing wildlife-vehicle collisions.

Since Californians passed Proposition 117 (The California Wildlife Protection Act of 1990) more than three decades ago, our state has recognized the special importance of mountain lions and afforded them unique protections. Numerous state agencies, as well as local and private stakeholders, have devoted significant resources over the years to preserve and enhance our lion populations. For example, efforts are underway to provide a wildlife crossing at Liberty Canyon to facilitate travel of mountain lions and other wildlife across the Ventura Freeway, with funding in part from the California Department of Fish and Wildlife. These efforts are laudable, but given the current threats facing the species, we must do more if we are to ensure our lions persist into the future.

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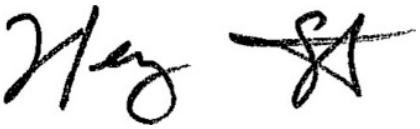
[1] Díaz *et al.* Pervasive human-driven decline of life on Earth points to the need for transformative change. *Science* 366, eaax3100 (2019); Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. *Global Assessment Report on Biodiversity and Ecosystem Services.* (IPBES Secretariat, Paris, France, 2019).
[2] Gustafson, K.D. *et al.* Genetic source-sink dynamics among naturally structured and anthropogenically fragmented puma populations. *Conservation Genetics*, 20, 215 – 227 (2019).
[3] Benson, J.F. *et al.* Extinction vortex dynamics of top predators isolated by urbanization. *Ecological Applications,* 29(3), p.e01868 (2019).

Now is the time to act to save these noble creatures. Protecting Southern California and Central Coast mountain lions under CESA will provide us with the legal tools and policy guidance to do so, before it's too late.

Thank you for considering our views.

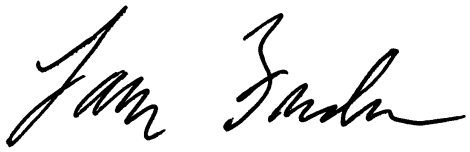
Sincerely,



Senator Henry Stern
Senate District 27
Chair, Senate Natural Resources and Water Committee

Senator Ben Allen
Senate District 26
Chair, Senate Environmental Quality Committee

Assembly Member Richard Bloom
Assembly District 50
Chair, Assembly Budget Subcommittee #3 for Resources and Transportation



Assembly Member Laura Friedman
Assembly District 43
Chair, Assembly Natural Resources Committee

Assembly Member Kevin Mullin
Assembly District 22
Speaker pro Tempore

From: Courtney McVean <courtney.mcvean@friendsofanimals.org>
Sent: Friday, March 27, 2020 12:13 PM
To: FGC <FGC@fgc.ca.gov>
Subject: Comment - CESA Listing for the Southern California and Central Coast ESU of mountain lions

Please find attached a comment in support of CESA listing for the Southern California and Central Coast ESU of mountain lions. According to media reports, The California Fish and Game Commission is expected to take up the issue at its April 15 and 16, 2020 meeting in Sacramento.

Thank you for the opportunity to comment.

Courtney Renee McVean
Associate Attorney
Friends of Animals, Wildlife Law Program
7500 E. Arapahoe Road, Suite 385
Centennial, Colorado 80112
Phone: 720-949-7791
Fax: 888-236-3303

EXPLOITERS
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of ANIMALS

EXPLOITERS
FRIENDS
of ANIMALS

April 2, 2020

VIA E-MAIL (fgc@fgc.ca.gov)

California Fish and Game Commission
1416 Ninth Street, Room 1320
Sacramento, CA 95814

Re: Comment in Support of Listing Mountain Lions in Southern and Central California as Endangered or Threatened Under the California Endangered Species Act

Dear California Fish and Game Commission:

Friends of Animals[1] submits these comments in support of the Petition submitted by the Center for Biological Diversity and Mountain Lion Foundation to List the Southern California and Central Coast evolutionarily significant unit (ESU) of mountain lions as endangered or threatened under the California Endangered Species Act (CESA) (hereinafter, "Petition"). Friends of Animals fully supports the actions and recommendations proposed in the Petition. Furthermore, Friends of Animals encourages other states to provide similar protections to mountain lions across the nation.

The Petition presents substantial evidence supporting listing mountain lions (*Puma concolor*; cougar, puma) in Southern and Central California as threatened or endangered pursuant to the CESA, California Fish and Game Code §§ 2050 *et seq*. The Petition demonstrates that Southern and Central California mountain lions are eligible for and warrant listing under the CESA based on the factors specified in the statute and implementing regulations. Specifically, the Petition requests that mountain lions in six specific areas[2] comprise an ESU and meet the statutory definition of a "threatened species." Alternatively, the Petition requests that, in the event the California Fish and Game Commission determines that these six populations collectively either do not comprise a single Southern California/Central Coast ESU or otherwise do not meet the

[1] Friends of Animals is a non-profit international advocacy organization incorporated in the state of New York since 1957. Friends of Animals has nearly 200,000 members worldwide. Friends of Animals and its members seek to free animals from cruelty and exploitation around the world, and to promote a respectful view of non-human, free-living and domestic animals.

[2] The six specific areas include (1) Santa Ana Mountains; (2) Eastern Peninsular Range; (3) San Gabriel/San Bernardino Mountains; (4) Central Coast South (Santa Monica Mountains); (5) Central Coast North (Santa Cruz Mountains); and (6) Central Coast Central.

criteria for listing as threatened, the California Fish and Game Commission should consider whether any of these populations, singularly or in combination, comprise one or more ESUs and meet the criteria for listing as threatened or endangered pursuant to CESA.

As discussed in the Petition, habitat fragmentation by urban development and highways, extremely low levels of genetic diversity, disease, rodenticide poisoning, vehicle collisions, and human-caused wildfires are serious problems shared by mountain lions in each of those ranges.

The loss of mountain lions in Southern California and the Central Coast would be devastating – not just for the mountain lions themselves, but also the many species that directly and indirectly rely on them. These top predators are important "ecosystem engineers" that facilitate healthy ecosystems and allow biodiversity to thrive. Just as beaver ponds create habitat for fish, amphibians and other species, lion kills create habitat for nature's janitors, insect "decomposers" that break down rotting flesh and liberate nutrients for soil microbes and plants.

Additionally, CESA listing would further Proposition 117's goals of protecting and restoring wildlife habitat as human populations increase and would build upon its protections by establishing an affirmative duty to ensure the survival and recovery of the Southern California and Central Coast mountain lions.

Friends of animals, therefore, encourages the California Fish and Game Commission to list the to list the Southern California and Central Coast ESU of mountain lions as threatened under the CESA. Friends of Animals further encourages the Commission to follow the recommendations proposed in the Petition for the management and recovery of Southern California and Central Coast mountain lion populations

Sincerely,

Courtney McVean
Associate Attorney
Friends of Animals, Wildlife Law Program
7500 E. Arapahoe Road, Suite 385
Centennial, CO 80112
720-949-7791
courtney.mcvean@friendsofanimals.org

From: Joan Licari [redacted]
Sent: Monday, March 30, 2020 12:53 PM
To: FGC <FGC@fgc.ca.gov>
Subject: Comments on ESU Listing for Mountain Lions

To Whom it May Concern:
Please find attached comments submitted by the San Gabriel Valley Task Force, Angeles Chapter of Sierra Club concerning the proposed listing of Southern California/Central Coast Evolutionarily Significant Unit (ESU) of Mountain Lion as a threatened species under the California Endangered Species Act.

Joan Licari, Chair
San Gabriel Valley Task Force
Angeles Chapter of Sierra Club

3250 Wilshire Blvd
Suite #1106,
Los Angeles, CA 90010

(213) 387-4287
(213) 387-5383 fax
angeles.sierraclub.org

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San Gabriel Valley Task Force

To:

Eric Sklar, President
California Fish and Game Commission
P.O. Box 944209
Sacramento, CA 94244-2090
fgc@fgc.ca.gov

From: Joan Licari
Chair, San Gabriel Valley Task Force
Angeles Chapter of Sierra Club

Re: Letter of support for Petition to list the proposed Southern California/Central Coast Evolutionarily Significant Unit (ESU) of Mountain Lion as a threatened species under the California Endangered Species Act

Date: March 26, 2020

Dear President Sklar and Members of the Commission:

This letter is submitted by the San Gabriel Valley Task Force of Angeles Chapter of Sierra Club in support of the listing of the proposed Southern California/Central Coast Evolutionarily Significant Unit (ESU) of Mountain Lion as a threatened species under the California Endangered Species Act.

The San Gabriel Valley Task Force was organized by the Angeles Chapter of the Sierra Club in 1999 to work with San Gabriel Valley cities and political leaders to seek ways to create a more livable environment for valley residents while preserving or improving natural habitat. Since that time, we have worked with cities of the San Gabriel Valley and Los Angeles County/Orange County to create projects that promote low impact outdoor recreation along the urban rivers in San Gabriel Valley, and to preserve natural habitats in foothills of the San Gabriel Mountains and the Puente-Chino Hills.

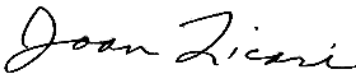
In February, the California Department of Fish and Wildlife recommended that the Center for Biological Diversity's legal petition to list Central Coast and Southern California mountain lions under the California Endangered Species Act may be warranted. **We ask the California Fish and Game Commission to accept the Department's recommendation and grant protection to these imperiled populations.**

Our Task Force has been working with local, State and Federal governmental agencies and environmental organizations to maintain and develop wildlife corridors connecting broad areas extending from the San Gabriel Mountains, down the San Gabriel River to Whittier Narrows, through the Puente-Chino Hills to Chino Hills State Park and into the Santa Ana Mountains to maintain the viability of ecosystems within the areas. Studies indicate the Santa Ana lion subpopulation, which travels north through Chino Hills State Park, Carbon Canyon and even through an underpass between Orange and Los Angeles counties into the Puente Hills in La Habra Heights, Rowland Heights and Hacienda Heights could be extinct within 12 years due to inbreeding. Studies also indicate the Santa Monica mountain lions population could die out in 15 years.

Listing of the lions will help secure the continued existence of populations and their genetic diversity rather than as islands of hereditary isolation. Failure to protect these populations will be detrimental to past efforts and monetary investment to preserve these animals and future viability of the ecosystems of which they are an important part.

We support the California Department of Fish and Wildlife in their evaluation of the Petition and their determination that research available is adequate for listing. Therefore, we ask that members of the Commission consider and accept the Petition when this topic comes up for action.

Respectfully submitted,



Joan Licari, D.Env.
Chair, San Gabriel Valley Task Force,
Angeles Chapter of Sierra Club
[redacted]

Midpeninsula Regional OpenSpace | Midpeninsula Regional Open Space District

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April 1, 2020

Mr. Eric Sklar, President
California Fish and Game Commission
1416 Ninth Street, Suite1320
Sacramento, CA 95814

RE: Letter of Support for Evaluating the Listing of the Mountain Lion Under the California Endangered Species Act

Dear President Sklar and Commissioners:

The Midpeninsula Regional Open Space District (Midpen) would like to take this opportunity to offer the following comments in reference to the proposed listing of mountain lions (*Puma concolor*) as Threatened under the California Endangered Species Act (CBD & MLF, 2019). Midpen manages roughly 65,000 acres of prime mountain lion habitat in the Santa Cruz Mountains and is committed to protecting regional mountain lion populations by preserving habitat, increasing habitat connectivity, minimizing human-wildlife conflicts, promoting bans and restrictions on rodenticide use and supporting research that improves our understanding of lion populations, ecology, and behavior throughout our region of influence.

As detailed in the petition to list, the Santa Cruz Mountain (SCM) lion population shares many of the same issues as the Santa Ana Mountains (SAM), San Gabriel/San Bernardino Mountains (SGSB) and Santa Monica (SMM) populations. All of these populations suffer from reduced habitat connectivity, poor genetic diversity and small effective population sizes (Gustafson et al. 2018). For these reasons Midpen supports the decision to evaluate the SCM population for inclusion in the proposed Evolutionarily Significant Unit (ESU). Conversely, there are significant differences between these populations that should be considered when evaluating the SCM population for listing. Unlike the SAM, SGSB, and SMM, the SCM have high quality habitat with a surplus lion population that act as a source for neighboring populations (Dellinger et al. 2019). Seven dispersal aged males from the SCM found their way into urban areas between 2014 and 2017 and required relocation by CDFW (CDFW data) indicating that available lion habitat is already occupied by dominant males. The Florida Panther Recovery plan suggests minimum densities of 2-5 lions per 100 square miles (USFWS, 2008). There are 1,387 square miles in the Santa Cruz Mountains bioregion. Based on the conservative estimate of 33-66 adult mountain lions (Gustafson et al. 2018) the SCM reaches the recommended minimum density with 2.38-4.76 lions per square mile. Considering that sub-adults, juveniles, and cubs are not included in this estimate it is likely that lion densities are considerably higher in the SCM. This indicates that the SCM population is not suffering from low population numbers relative to available habitat, but rather a lack of genetic diversity within the population, limited habitat connectivity between neighboring populations, and

increasing human use within available habitat. If lions in the SCM are listed, the recovery criteria should be designed to reflect this distinction by including a threshold of minimum genetic diversity and improved connectivity for recovery. Furthermore, robust, multi-year population studies will be required to determine the effectiveness of additional protections for mountain lions.

As a public land management agency Midpen strives to minimize potential human-wildlife conflicts to the greatest extent possible. Many of our preserves offer high quality lion habitat that directly abut densely populated urban areas with considerable potential for interactions between humans and mountain lions. Midpen has a strong focus on public outreach and education through interpretive signage, on site tabling, interviews with persons reporting lion activity, and adaptive management of trail access in response to potential human safety issues. Unfortunately, two of the seventeen verified mountain lion-human attacks in California since 1986 have occurred on Midpen preserves. The most recent attack took place on February 16th, 2020 at Rancho San Antonio Open Space Preserve (Rancho). At this preserve, lion sightings are reported roughly once per month and lions have been seen at all times of the day throughout all months of the year. As both lion and human populations in the area increase, and human-lion interactions become more common, lions occupying habitat along the urban interface may become more likely to exhibit bold behavior around people. Mountain lion attacks, though rare, are a risk to human safety that cannot be ignored. Furthermore, when attacks do occur, lions are killed in response to protect human safety. Midpen believes that non-lethal behavioral modification research to keep lions wary of human activity would be a benefit to mountain lions and to public safety. Midpen is also interested in studying human recreational use and/or habitat modification to reduce conflict.

In addition to research needs for non-lethal behavioral modifications of mountain lions to increase public safety where there is high human/mountain lion interactions, there is also a need for research on non-lethal deterrence methods to reduce livestock predation by mountain lions. In the last 10 years, 42 mountain lions have been lethally removed using depredation permits in Santa Cruz, Santa Clara, and Santa Cruz counties (CDFW depredation permit data). These three counties encompass the Santa Cruz Mountains and are all within Midpen's jurisdiction. This is significant considering the best available estimate of the number of lions in the Santa Cruz Mountains is 33-66 adult lions (Gustafson et al. 2018). In addition to legal depredation of lions, instances of poaching are known to occur along the San Mateo County Coast. In supporting additional protections for mountain lions, non-lethal tools will become increasingly important as livestock operators look for viable alternatives to reduce conflicts.
In support of ongoing wildlife and livestock protection policy work, Midpen hired Wildlife Conflict Specialist Dr. Veronica Yovovich to complete a comprehensive literature review detailing all available wildlife livestock conflict mitigation measures that have been evaluated through scientific research. This has been attached to this letter as a reference that may prove useful in determining appropriate non-lethal alternatives for livestock operators dealing with predation issues.

Midpen has worked closely with regional CDFW biologists and wardens in responding to both public safety issues and depredation caused by mountain lions. In this capacity we have learned that a key issue facing CDFW is their capacity to respond with existing staffing levels. If the recent decision to extend the "three-strikes" depredation permit process to cover the entire proposed ESU is to be successful, Midpen recommends that additional staff be hired to ensure that CDFW has capacity to issue and monitor these non-lethal permits, as well as to educate ranchers and the public on how to best protect their domestic animals. In addition, there needs to be more enforcement of existing protections for mountain lions to ensure that poaching is discouraged to the greatest extent possible. This may require coordinating with

local District Attorney's Offices to advocate that lion poaching cases be prosecuted to the fullest extent of the law.

Midpen is looking forward to continuing to work with CDFW to preserve mountain lions in the Santa Cruz Mountains and beyond. We believe that additional protections paired with robust research, support for habitat connectivity, further habitat preservation, and appropriate staffing for CDFW biologists and wardens, can ensure that mountain lion populations persist throughout the state

Sincerely,

Kirk Lenington
Natural Resources Manager

Sources Cited

Gustafson, K.D., et al. 2018 Genetic source-sink dynamics among naturally structured and anthropogenically fragmented puma populations. *Conserve. Genetics* **20**, 1-13.

Dellinger, J. (2019). Relationship between habitat and genetics in a wide-ranging large carnivore. Temecula, CA.

US Fish and Wildlife Service, 2008. Florida panther recovery plan (Puma concolor coryi), third revision. US Fish and Wildlife Service, Atlanta, 217.

Center for Biological Diversity and the Mountain Lion Foundation, 2019. A Petition to List the Southern California/Central Coast Evolutionarily Significant Unit (ESU) of Mountain Lions as Threatened under the California Endangered Species Act (CESA)

GRAZING MANAGEMENT POLICY AMENDMENT: WILDLIFE AND LIVESTOCK PROTECTION POLICY LITERATURE REVIEW

Created for the Midpeninsula Regional Open Space District

Created by Veronica Yovovich
in collaboration with Matthew Sharp Chaney, Kirk Lenington, Julie Andersen, and Elaina Cuzick

April 2019

Livestock and Carnivore Protection Policy Literature Review

Table of Contents

Executive Summary

In order to effectively manage livestock-carnivore interactions, it is important to understand how the ecological, legal, and management dynamics interact with one another. This review is designed to help District managers and producers evaluate which livestock protection tools may be most suitable for each particular operation on leased land.

This review can be broken down into the following five sections. The first provides an overview of relevant carnivore behavior and ecology for each of the three native focal species, mountain lion (*Puma concolor*), coyote (*Canis latrans*), and bobcat (*Lynx rufus*). Second is a summary of the laws and regulations governing the management of each of the native focal carnivore species, as well as an additional non-native species, domestic dog (*Canis familiaris*). This information serves to guide how various preventative tools may be legally implemented. Additional carnivore species (such as wolves and bears) are present in other parts of California, however, they are not present on District properties and are not covered by this review. The third section provides a review of direct (mortality and injuries) and indirect (weight loss, reduced reproductive potential, etc.) impacts to livestock that are incurred during livestock-carnivore interactions. Next follows an overview of policies implemented by other local land management agencies (such as East Bay MUD, East Bay Regional Parks, National Parks Service, etc.) that could serve as a model for the District. The final section, and bulk of the review, synthesizes research on a variety of conflict mitigation tools, ranging from visual and auditory frightening devices to lethal removal. Each method is described in detail, outlining the means of protection, suitability for which species of livestock, suitability for which species of carnivore, potential drawbacks and benefits, and scalability (as tenant operations vary from small 200 to 500 acre ranches with 20 to 100 cattle to large ranches covering over 3,000 acres with a few hundred cattle). The District defines livestock as horses, cattle, sheep, and other useful animals kept or raised on farms or ranches; there are tools outlined below designed to protect each of those species. The ultimate goal is to promote and implement practical, effective animal husbandry practices that will allow livestock and carnivores to coexist on District properties.

Introduction

Midpeninsula Regional Open Space District's (hereafter "the District") mission is to provide opportunities for public enjoyment and education while conserving and restoring open space in perpetuity. Preserving these wild habitats requires maintaining the diverse array of native plant and animal species that play important roles in overall ecosystem health. One way in which the District achieves this goal is by implementing conservation grazing activities that simultaneously maintain natural processes in a landscape that coevolved with large grazing animals (Edwards 1996), help mitigate the impacts of nonnative species (Stromberg et al. 2007), as well as support the deep historic roots of livestock ranching in the Central Coast. Preserving the local plant community provides the foundation on which native wildlife persist. Among the species that indirectly rely on these healthy rangelands are the native carnivores, such as

mountain lions, coyotes, and bobcats. These populations both rely on and contribute to maintaining habitat integrity by helping regulate prey populations (Miller et al. 2001), reducing pest species density and disease transmission to humans (Ostfeld and Holt 2004, O'Bryan et al. 2018), etc.

Balancing these varied, and sometimes at odds, components of healthy open space habitats requires careful, dynamic management. The District is dedicated to fostering viable livestock production alongside a healthy carnivore community. To this end, this document explores strategies for preventing negative interactions between livestock and carnivores, thereby promoting sustainable conservation while protecting domestic animals, native carnivores, and human livelihoods alike.

The most common livestock on District property is cattle, however there are smaller operations with llamas, alpacas, sheep, goats, pigs, donkeys, mules, horses, chickens, and other species may be present in the future. This review addresses strategies to keep each of these types of livestock safe from predation by mountain lions, coyotes, domestic dogs, and bobcats.

Much of the current research on depredation prevention in North America has focused on interactions between coyotes and sheep, wolves and cattle, or wolves and sheep. In addition, experimental studies evaluating tool efficacy are rare (Eklund et al. 2017), and were most often developed in other parts of the country. Though there has been little research on mountain lion predation on cattle, especially in California, this review extrapolates results from studies focusing on interactions between other species, and combines that information with distinct facets of mountain lion behavior and ecology to provide guidance where rigorously tested data are lacking.

This document is meant to be as comprehensive as possible to allow District staff and tenants to weigh potential options, but it is by no means exhaustive. This review is informed by scientific research wherever possible, however, there is a significant scarcity of rigorous experimental testing within the field of livestock-carnivore conflict prevention (Miller et al. 2016, van Eeden et al. 2018). While the lack of research limits our ability to fully evaluate the efficacy of each method and weigh them against one another, there is appreciable amount information available to guide producer decisions. It should also be noted that there are legal restrictions on activities; some tools and techniques may be legal on a state or federal level, however they may not be currently permitted under District policies. All activities should be pursued in coordination with the District and granted written permission before implemented.

I. Carnivore Natural History, Management, and Ecology

Coyotes

Coyotes are a plains and grassland adapted species whose flexibility has allowed them to thrive in a wide variety of habitats. Before European settlers first arrived to the U.S., coyotes were mostly limited to the Central U.S. and Mexico. As humans extirpated wolves and expanded agricultural land throughout the 1800s, new habitat opened up for coyotes. Despite

heavy persecution via poisoning, trapping, and hunting, coyotes successfully expanded their range across the U.S. and into much of Canada (Agocs 2007, Levy 2012).

As human and livestock populations grew, so did conflict with coyotes. Though up to 90 percent of their natural diet consists of small mammals (Bekoff 1977), coyotes can predate on small to medium livestock (such as sheep, calves, fowl, etc.), and harass larger animals (such as cattle). The traditional approach to solving these problems has been to reduce or eradicate coyotes with the goal of reducing depredations. However, in order for these programs to be successful, a significant portion of the coyote population, roughly 75 percent, needs to be eliminated each year (Connolly and Longhurst 1975). This kind of eradication program is resource intensive, not practical in most locations, and runs counter to the District's mission. In addition, public attitudes have shifted over time and acceptance of predator eradication programs has diminished, making it increasingly important to find new tools for preventing conflict (Andelt 1996, Reiter et al. 1999, Bruskotter et al. 2009, Slagle et al. 2016).

New research has also begun to shine light on the important ecological role coyotes play by regulating smaller carnivores and indirectly increasing songbird and water fowl diversity and abundance (Soule et al. 1988, Rogers and Caro 1998, Crooks and Soulé 1999). Coyotes can also benefit livestock and their human counterparts. Coyote removal can allow rodents and rabbits to become more abundant, in some cases to the point of competing with livestock for forage (Henke and Bryant 1999, Ranglack et al. 2015). In addition, rodents can also have significant negative economic impacts on California's agriculture (Gebhardt et al. 2011). Left intact, coyote populations control rodent and rabbit populations as their primary prey species, which can help alleviate rodent-caused economic burdens on agricultural producers. A benefit extending beyond rangeland managers, by helping control rodent populations, coyotes can reduce the prevalence of rodent-borne zoonotic diseases as well (Ostfeld and Holt 2004, O'Bryan et al. 2018).

Tenant survey respondents indicated that solo coyotes do not pose a significant threat to cattle, but that group hunting is an issue (see Supplementary Materials Tenant_Survey). Research on pack formation suggests that coyotes may coalesce in groups in response to decreases in small prey and switch to larger animals, such as deer (Bowen 1981). In order to prevent coyotes from forming social groups, it could be beneficial to look into whether small prey item abundance has decreased on District properties (such as from rodenticide use), and whether there are ways to avoid reducing lagomorph and rodent populations. Research suggests that coyotes prefer native prey, and bolstering these populations may reduce feeding on livestock (Linnell et al. 1995, Sacks and Neale 2002). Other research suggests that coyotes may form packs in order to ensure pup survival (Messier and Barrette 1982). One way to manage this aspect of pack formation could be to modify or halt activities that decrease pup survival (such as culling adults during breeding season, restricting domestic dog access to areas with known dens, rodenticide use, etc.).

Informal tenant reporting also suggests that livestock grazing in pastures containing coyote dens or in close proximity to den sites are at greater risk of being harassed or killed. Coyotes living on District property appear to routinely use established den sites for rearing pups

year after year, and many of these sites are readily identifiable (Chaney, personal communication). If a particular pair of resident coyotes has a history of living in the area without depredating livestock, it may be in the producer's best interest to let them be; as removing the pair would open the territory, and it could become occupied by coyotes with a greater tendency to prey on livestock. However, if there have been injuries or depredation incidents, CDFW personnel suggest disrupting denning behavior (collapsing the den or filling it in with rocks) close to pupping season (usually May through June). A variation that might more closely align with District objectives would be to disrupt the den site during a time of year when the site is vacant (usually August through February). With the established den rendered inoperable, the breeding pair may decide to choose a new location in an area with fewer livestock, thereby reducing local depredation risk. CDFW has no specific restrictions on how property owners may alter unoccupied coyote dens on their property. However, in locations where special status species occur, consultation with CDFW may be required before collapsing dens.

In general, coyote predation may be higher in pastures that contain rough terrain, creeks, or brush sufficient to conceal a coyote – therefore, stocking younger or sick calves in more open habitat (where possible) could help improve safety (Pearson and Caroline 1981) (see Altering Pasture Vegetation and Grazing Regimes below). Similar to mountain lions, coyotes are more effective predators on cattle in closed habitat and/or rugged conditions than in open areas (Hulet et al. 1987, Jones 1987). Coyotes select for newborns, calves, and birthing cattle over adults, making it prudent to keep these groups in open pastures, behind coyote-proof fences (see fencing section for description), or protected by some other method to decrease risk to predation (Jones 1987, USDA 2015a).

Mountain Lions

Historically, mountain lions had the widest distribution of any terrestrial mammal in the western hemisphere, occupying habitat from the Yukon to the southern tip of South America (Logan and Sweanor 2001). Native to California, including San Mateo, Santa Clara, and Santa Cruz Counties, they were once widely distributed across the state and resided in nearly any type of habitat, from the Mojave to the Sierra. As an effective ungulate predator, almost everywhere deer were found, mountain lions could be found too.

As European settlers moved West and their population in California grew, conflicts with mountain lions increased. Mountain lions and other carnivores were subject to government eradication programs in an attempt to reduce their potential impact on livestock. Starting in 1907, mountain lions were classified as a "bountied predator," and over 12,000 mountain lions were harvested before the bounty was lifted in 1963 (data available from CDFW). Habitat models created by CDFW estimate that California's mountain lion population could have been as high as 6,000 (CDFW 2018), but by 1921, they speculated that eradication efforts had successfully reduced this "varmint" down by as much as 90 percent of the natural population statewide (CDFG 1921). This large-scale population reduction made mountain lion occurrences

rare in many parts of the state, including San Mateo County, and is likely the source of the perception that mountain lions are a newcomer or introduced to the Central Coast, despite historic records indicating their longstanding presence (Lawrence 1913, CDFG 1921, MVZ 1940, Field, 2003, Williams 2003, Marciel 2006, Dougherty 2007).

The bounty was repealed in 1963, and the species was reclassified as a "non-protected mammal." Six years later, they were once again reclassified as a "game mammal" so that wildlife managers could use regulated hunting in an attempt to curtail livestock depredations. Proposition 117 was passed in 1990, designating mountain lions a "specially protected mammal." Mountain lions were not state or federally threatened or endangered, but Californians decided to protect the state's last remaining apex carnivore. This title confers special protections against take of any variety without a depredation permit. In the years since the bounty was lifted and protections were put in place, mountain lion populations have made a significant recovery.[1] This relatively recent population rebound has likely contributed to the rise in depredations and human encounters with mountain lions.

Despite the attention mountain lion management has received over the last 100 years, surprisingly little is known about the size of California's mountain lion population. Their cryptic nature and lack of individually identifiable traits, makes mountain lions notoriously difficult to survey. Recent habitat models created by CDFW suggest the statewide population is close to 3,000 individuals, however further research is currently underway to create a more finely tuned estimate (Dellinger 2018).

Mountain lions prefer to hunt away from human development, and even in rural or exurban environments with abundant secondary prey, roughly 98 percent of the biomass consumed by mountain lions comes from deer (Yovovich 2016, Wilmers et al. 2013). Though mountain lions strongly select for deer, they may opportunistically eat other prey items, such as opossums, raccoons, feral pigs, elk, or domestic pets and livestock (Yovovich 2016). Like most other carnivores, they will also opportunistically scavenge carcasses they encounter.

When mountain lions take livestock, it is more common that they take sheep or goats. Less than 10 percent of statewide lethal take permits are cattle-related (Dellinger 2018), despite there being far more cattle than goats or sheep in California (CDFA 2014). In most cattle depredation cases, calves are taken when they are smaller than 140kg (308lbs) (Shaw 1977).

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[1] Monitoring mountain lion population size at the state level is a logistically difficult and resource intensive. Though there is little direct measure of mountain lion populations in California through time, by piecing together data from a variety of sources, one can piece together indirect estimates of population size and trajectory. Harvest rates are often used as an index for population trends when suitable monitoring data are not available (Cattadori et al. 2003). Holding hunting effort constant, a change in the ability for hunters to harvest animals indicates a change in the animal population. Using bounty records in this same way could reflect patterns in the mountain lion population. Data collected by the state show a marked decline in bounties collected between the early 1900s and when the practice was ended in 1963, indicating that the mountain lion population likely declined during this period. State records of mountain lions harvested between the late 1960s and now, this time through hunting and depredation permits, remain low until the late 1970s, then rise through the 90s, and level off in the mid 90s. This could indicate that the population was greatly reduced by the early 60s, began to recover in the 70s and 80s, reaching a high point in the 90s, and has leveled off to some degree since then. (Bounty records and depredation data are available from CDFW)

Keeping cattle in close proximity to human activities or in protective structures during vulnerable times can successfully prevent depredations (Shaw et al. 1988, Linnell et al. 1996, Larson 2018). Though more appropriate for small-scale livestock operations, this may be a useful tool for temporarily isolating and protecting injured, sick, or other high-risk individuals. Mountain lions rely on stealth when hunting, making habitats with thick vegetation a higher risk for livestock. Feeding and watering livestock in open habitat where there is little cover to hide and stalk within a close distance can help increase livestock safety.

Bobcats

Bobcats inhabit a wide variety of habitat types across southern Canada into central Mexico. They primarily feed on rabbits, and rodents, though they may also consume birds, insects, ungulate fawns, and small livestock or domestic animals. Bobcats can be significant predators to pronghorn or deer newborns/fawns; however, predation risk rapidly decreases as wild ungulate young grow (Linnell et al. 1995). Bobcat predation on wild ungulate young is typically higher in forests than in mountainous or open areas (Linnell et al. 1996).

Though bobcats may prey on wild ungulate young, there is little evidence that they pose much risk to livestock. Research at Hopland Research Extension Center suggests that bobcats may scavenge sheep carcasses, but are not likely to hunt medium to large livestock, not even lambs (Neale et al. 1998). There is scant information in the scientific literature about the relationship between beef cattle or calves and bobcats, which could indicate that there has been little conflict between the two. One study addressing this directly found that bobcats were not responsible for cattle depredations of any variety (Scasta et al. 2017). This result is reflected in the livestock operator surveys conducted by District staff (see Supplemental Material Tenant_Survey). With all of this in mind, it is very likely that cattle and calves are simply too large for bobcats to pose a significant threat, however, they could prove problematic to chickens, fowl, or other small livestock.

II. Legal Status and Regulations

Coyotes

In California, coyotes are designated as a nongame mammal and may be hunted any time of year with no limit on number, provided that all other hunting laws and local regulations are followed (CCR14 §472). Any body-gripping traps, including Conibear traps, and snares are prohibited for recreational or commercial purposes (FGC §3003.1 and CCR 14, §465.5). As nongame mammals, coyotes that injure livestock may be taken at any time or in any manner in accordance with the Fish and Game Code by the owner, tenant of the premises, or employees thereof (FGC §4152 and §4180) assuming no conflict with local ordinances or regulations. In San Mateo, Santa Cruz, or Santa Clara Counties, dogs may be used by federal and county animal damage control officers or permittees to pursue or take depredating coyotes (FGC §265). CDFW does not live trap and relocate problem coyotes.

Bobcats

Bobcats are considered non-game mammals in the state of California. As such, they may be hunted in season, and hunters with appropriate tags may take up to 5 bobcats of either sex per season (14 CCR §478(b)). FGC §3960.6 allows livestock operators to use livestock guarding dogs to protect their domestic animals and property from bobcats as long as the dogs are maintained within or in close proximity to the property.

A bobcat caught in the act of injuring or killing livestock may be taken immediately, as long as a permit is obtained within 24 hours of the incident (14 CCR §401(a)). This depredation permit allows a landowner to use up to three trailing hounds to pursue, haze, or lethally remove the offending bobcat. The permit is valid for up to 20 consecutive days and may be renewed if depredations continue (14 CCR §401(b), FGC §3960.2). It is illegal to use steel-jawed leghold traps or poison, and the animals must be dispatched in a humane manner in which death is delivered instantly. Third party compensation for performing depredation services is illegal (FGC § 3960.2).

Coyote and Bobcat Hazing and Hunting Regulations

In 1998, California voters passed Proposition 4, which banned the use of sodium cyanide and sodium fluoroacetate (Compound 1080), two poisons employed by federal USDA WS trappers for killing coyotes, bobcats, and other carnivores. It also prohibited the use of steel jawed leg-hold traps and body-gripping traps for commercial and recreational trapping (CDFG 1998). Both non-lethal (with the proper permits) and lethal snares remain legal for trapping, animal damage management, and predator control purposes.

Hazing is legally permitted by CDFW code (14 CCR § 251.1 § 251.1. Harassment of Animals), which states the following, “except as otherwise authorized in these regulations or in the Fish and Game Code, no person shall harass, herd or drive any game or nongame bird or mammal or furbearing mammal. For the purposes of this section, harass is defined as an intentional act which disrupts an animal's normal behavior patterns, which includes, but is not limited to, breeding, feeding or sheltering. This section does not apply to a landowner or tenant who drives or herds birds or mammals for the purpose of preventing damage to private or public property, including aquaculture and agriculture crops.” The CDFW code does not enumerate every legal tool, however, yelling; throwing rocks; advancing on coyotes; shooting them with a water gun, rubber bullets, or other less-than-lethal munitions are permissible; as are other non-lethal tools (Kasteen, personal communication; Monroe, personal communication).

Mountain Lions

Though California Department of Fish and Wildlife does not currently have a formal mountain lion management plan, laws do restrict how humans may interact with them. Proposition 117 (FGC §4800-4809), passed in 1990, designated mountain lions a “specially protected mammal” in California, permanently banning mountain lion hunting, possession, and

take of any variety. The only context in which take is legally permissible is if a mountain lion poses an immediate safety threat, or a mountain lion threatens a human's personal safety or the safety of their livestock or companion animals. In those cases, state law requires CDFW to issue a depredation permit for the offending animal, or appropriate responding agents can lethally remove an individual animal. A game warden or other authorized agent may visit the site in person to verify that the animal responsible for the incident was a mountain lion, however in some cases, a permit may be issued over the phone. A mountain lion caught in the act of injuring or killing livestock or domestic animals, may be lethally taken immediately by the owner of the property, an employee, or agent of the property owner, provided the incident is reported to CDFW within 72 hours. At that point, CDFW personnel will investigate and verify the incident (FGC §4800-4810).

A depredation permit allows one mountain lion to be killed or harassed, and expires 10 days after it is issued. The permittee is allowed to begin pursuing the mountain lion no greater than one mile from the depredation site, and the pursuit is limited to a 10-mile radius from the initial incident. Under a depredation permit, a mountain lion must be dispatched in an efficient and humane manner in which death is delivered instantly; they may not be poisoned, trapped by leg-hold or metal-jawed traps, or snares. If depredations continue to occur, the livestock operator may apply for additional permits (FGC §4800-4810).

There are two notable exceptions to the general depredation process, the Santa Ana Mountains and the Santa Monica Mountains. These two locations have a few characteristics in common; they are each home to an isolated population of mountain lions in danger of extirpation within the foreseeable future (Ernest et al. 2014, Benson et al. 2016), and a growing number of ranchette-style development and associated small-scale livestock. This intersection of vulnerable livestock and a precarious mountain lion population elicited special attention from state biologists. In 2017, CDFW decided to provide extra support to livestock operators in the region and redefine how the state manages depredation incidents in these two areas.

In these two locations, if a confirmed depredation event occurs (FGC §4803), CDFW will grant permission to the livestock operator to haze the depredating mountain lion if "the immediate pursuit will assist in the non-lethal removal of the mountain lion from the property" (FGC §4805). In addition, the responding agent will discuss potential preventative tools for preventing further depredation incidents. If a second depredation event occurs in a timeframe that "suggests an affinity for the site," the livestock operator is again granted permission to haze the offending individual and the issuing agent will suggest additional preventative tools. If a third event occurs in a similar time window, and the livestock operator requests a lethal removal permit, the permit will be granted.

In 2013, Senate Bill 132 (FGC §4801.5) was passed, creating new protocols and protections for "no harm no foul" mountain lions that wander into human-populated areas and do not pose an immediate public safety threat. This law allows CDFW staff to partner with other qualified organizations or individuals to safely tranquilize and transport mountain lions a safe distance from humans and re-release the individual into habitat from which it may have come. Animals are usually released in a location within their likely home range, which makes this tool

distinct from translocations in which animals are transported into new habitat with the goal of reestablishing that animal in a new territory where it is unlikely to encounter humans. In the case of translocations, animals may return to the area in which they were captured, resume their previously problematic behavior, and/or suffer high mortality rates in their new location. Translocation as a conflict management tool is resource intensive and does not improve the underlying husbandry context in which the issue arose (Linnell et al. 1997). CDFW does not currently use translocation as a tool for resolving conflicts between mountain lions and humans. As mentioned above, there are rare situations in which CDFW will move a mountain lion a short distance, such as in the event that a one is found in an urban or suburban area and it is displaying nonaggressive behavior. In such a case, local agents may tranquilize and move the mountain lion back into the nearest suitable habitat from which it most likely originated (with permission from the owner of the release site property).

Domestic Dogs

Fish and Game Code governs how to manage interactions between dogs and native ungulates (see FGC § 3961), while Civil Code manages dog-livestock interactions. Section 31103 states that "any dog entering any enclosed or unenclosed property upon which livestock or poultry are confined may be seized or killed by the owner or tenant of the property or by any employee of the owner or tenant," and goes on to say that "if a livestock owner suffers injuries from livestock killed by dogs and the owner cannot be identified, he may recover from the county in which the damages occurred." The dog owner may be liable for up to twice the amount of the actual damages inflicted by the dog (Cal. Food & Agric. Code § 31501). Civil Code (Ch 5 §31102) allows any person to kill dogs caught in the act of killing, wounding, or harassing livestock on land or premises which are not owned or possessed by the owner of the dog, or if proof is presented that conclusively demonstrates that the dog has been recently engaged in killing or wounding on land not owned or possessed by the dog's owner.

District Land Use Regulations

The District follows management policies that ensure proper care of the land, that provide public access appropriate to the nature of the land, and that are consistent with ecological values and public safety. All District lessees, contractors, consultants, agents and representatives shall abide by all provisions of the below ordinances unless the provision(s) conflicts with a written contract or agreement with the District. Some of these regulations directly relate to potential actions meant to deter depredation. Exceptions to these regulations can be made by written agreement. Pertinent ordinance sections are detailed below:

Section 403. Firearms, Traps, Weapons, and Dangerous Devices

403.1 General.

a) No person shall carry, possess, use, set, leave or deposit, fire or discharge, or cause to be fired or discharged, across, in, on, or into any portion of District Lands any gun or firearm, spear, missile, bow and arrow, cross bow, sling shot, trap, snare or hunting

device, ammunition, throwing knife, hatchet, axe, sword, machete, martial arts throwing device, any device capable of firing or launching a projectile, or any other weapon or device not otherwise specified, capable of injuring or killing any person or animal. Violation of this sub-section is punishable as a misdemeanor.

b) No person shall carry, possess, set, leave or deposit, fire or discharge, or cause to be fired or discharged, across, in, on, or into any portion of District Lands any paint ball gun, BB gun, air gun or similar device.

403.2 Exceptions. This section shall not apply to:

a) the possession of otherwise lawful unloaded firearms or dangerous weapons on public roads solely for the purpose of transporting such firearms or dangerous weapons through District Lands for lawful purposes;

b) the possession of otherwise lawful firearms or other dangerous weapons at a place of residence or business located on District Lands by a person in lawful possession of the residence or business;

c) the possession and use of such firearms or weapons granted by written permit for resource management or educational purposes

Section 700. Hunting, Fishing, Collecting, and Feeding

700.1 Hunting.

No person shall possess, hunt, pursue, molest, disturb, injure, trap, snare, take, net, poison, introduce, release or harm or attempt to hunt, pursue, molest, disturb, injure, trap, take, net, poison, introduce, release or harm any mammal or bird, or any other wild animal living or dead. This section shall include taking of any part of the mammal or bird. Violation of this sub-section is punishable as a misdemeanor

Section 701. Animals.

701.1 Dogs.

a) No person shall have more than three dogs per person within areas where dogs are allowed on District Lands.

b) No person shall allow or have a dog on District Lands except in those areas designated by the District. This subsection shall not apply to:

1) guide and service dogs under physical control, specifically trained to assist the blind, deaf, or disabled;

2) guide and service dogs in training to assist the blind, deaf, or disabled, and under physical control, and participating in a training program,

3) use authorized by written permit.

c) Leash Required.

No person shall allow or have a dog on District Lands, unless the dog is at all times under control, and on a leash not to exceed 6 feet, or on a self-retracting leash with a maximum extended length of 25 feet. The leash must be held by person responsible for the dog and must be made of material and construction sufficient to restrain the dog. Electronic or other "invisible leashes" do not meet the leash requirement. The self-retracting leash must have the capability of being retracted and locked in a position not to exceed 6 feet. Within a designated area, no person shall have or allow a dog on a lead greater than 6 feet when:

1) Within 100 feet of any parking area, trailhead, picnic area, campground, horse stable, public roadway, restroom, visitor center, ranger station, or other place or structure of public assembly;

2) Within 50 feet of any person that is not the person or persons who entered District lands with the dog; or

3) Within 50 feet of any District Water Area.

4) When the dog is not visible to the owner

d) Off-Leash Areas.

Dogs shall be permitted off leash only in areas specifically designated and signed by the District as off-leash areas. No person shall allow or have a dog in an off-leash area unless the dog is at all times under the verbal or radio collar control, and in sight of, its owner or person responsible for the dog. The owner or person responsible for the dog shall have a leash in his/her possession at all times.

e) Nuisance Dogs.

No person shall allow or have on District Lands a dog that is a nuisance to people, other animals, or property. This includes, but is not limited to: growling, excessive barking, scratching, jumping on any person or animal, or challenging in any manner, people, animals, or property.

f) Dogs in Water Areas.

No person responsible for a dog shall allow said dog to enter any District Water Area unless it is specifically designated to allow such entry.

g) Dangerous Dog.

No person shall allow or have on District Lands a dog that exhibits dangerous behavior including, but is not limited to: attacking, biting or causing injury to any person or animal. Violation of this section is a misdemeanor.

701.2 Disturbance or Injury to Wildlife.

No person shall allow a dog, cat, or domesticated animal, even if leashed, to disturb, chase, molest, injure, or take any kind of wildlife, whether living or dead, or remove, destroy, or in any manner disturb the natural habitat of any animal on District Lands. Violation of this sub-section is punishable as a misdemeanor.

701.3 Horses and Livestock.
No person shall keep, raise or allow cattle, horses, sheep, or other livestock on District Lands, unless pursuant to a lease, license, written permit, or other entitlement of use granted by the District. Violation of this sub-section is punishable as a misdemeanor.

701.4 Other Pets.
No person shall allow or have any pet, domesticated animal, or other animal on District Lands, unless specifically permitted by another section of these regulations.

III. Direct and Indirect Predation Impacts

Carnivores can have direct (such as injuring or killing) as well as indirect (such as harassing, persistent stress, etc.) impacts on livestock. Regardless of the outcome, these impacts can deliver significant economic costs to producers (Muhly and Musiani 2009). When ranchers are able to locate a carcass and determine whether the animal was lost to a carnivore, the economic impact to the producer can be quantified to some degree. However, indirect predation costs are far more complex. Recent research has begun to attempt to measure the impacts that carnivore presence and activities may have on livestock, and quantify the costs related to increases in stress, such as failure to gain weight, reduced reproductive output, additional livestock handling labor, etc. (Ramler et al. 2014). In addition, indirect costs may arise from lost genetic stock held within a depredated individual, training, and other difficult to measure internal factors. Every livestock animal represents generations of selective breeding. When that animal is killed, the profit from that individual is lost, and it also represents lost cost in the years invested by the rancher, as well as an opportunity cost to the future genetic potential of that lineage (Naughton-Treves et al. 2003). In fact, new research has shown that while ranches with resident wolves may not experience negative indirect impacts from wolf presence alone, ranches with a confirmed depredation incident may incur indirect costs greater than the cost of the depredation loss itself (Ramler et al. 2014).

National and Local Depredation Losses

Nationwide, and in California, non-carnivore sources of mortality, such as respiratory illness, foul weather, or calving related problems, dwarf the impact of predation (Table 1). In 2015, carnivore predation accounted for 2.4 percent of cattle mortality and 11.1 percent of calf mortality across the U.S., whereas non-carnivore sources accounted for 97.6 percent and 88.9 percent of cattle and calf mortality respectively. It is important to recognize, however, that depredation rates vary regionally and by livestock operation type. For example, beef calves and cattle may have depredation rates several times higher than dairy operations, and grizzly bear depredations are much more likely to be an issue in Idaho than in Oklahoma (USDA 2015a). On a more local scale, depredation rates can vary dramatically on a parcel-by-parcel basis (Treves et al. 2004). For example, overall livestock loss for the District as a whole has not exceeded 2 percent for any given year in the last 4 years. However, loss to a single producer has been as high as 6.98 percent in a year (Table 2).

In California, 1.1 percent of reported mature cattle mortality was attributed to carnivore predation, and 5.8 percent of reported calf mortalities were attributed to carnivore predation in 2015. Non-carnivore mortality sources accounted for 98.9 percent of adult cattle mortality, 94.2 percent of calf mortality. These various mortality sources amounted to an overall 2.4 percent of cattle inventory lost, and predation accounted for less than 0.1 percent of this overall lost inventory. For calves, non-carnivore mortality sources accounted for 6.6 percent overall calf crop loss, and predation accounted for 0.4 percent overall calf crop loss (Table 1). Even at such low rates, predation cost the state's livestock industry $1,896,631 in lost cattle and $4,789,565 in lost calves, and can have far greater proportional impact on individual operations (USDA 2015a).

Mortality Source	Percent Livestock Inventory Lost	
	Cattle	Calves
Predation	>0.1	0.4
Non-Predation	2.4	6.6
Respiratory Problems[1]	0.6	2
Mastitis	0.3	>0.1
Digestive Problems[2]	0.3	1.5

Table 1: Percent California's overall cattle and calf inventory loss derived from the most common mortality sources. Predation mortalities are the pooled losses to any carnivore found within California (wolves, mountain lions, bears, coyotes, domestic dogs, etc.). Non-predation mortalities are the pooled losses from any non-predation source (including respiratory issues, mastitis, lameness, etc.). At the state level, illnesses from respiratory or digestive issues are responsible for more calf and cattle deaths than depredations from mountain lions or coyotes, or all of the carnivore species combined. However, mortality sources on a local level may vary widely. (Data calculated from USDA 2015a)
[1]Such as pneumonia or shipping fever.
[2]Such as bloat, scours, parasites, enterotoxaemia, or acidosis.

On District grazing allotments, there has been a growing incidence of livestock depredation. Though livestock producers operating in the Central Coast have been ranching alongside carnivores for generations, and under District management since 2007, as local carnivore populations have recovered in recent years, depredations and other conflicts between livestock and carnivores have increased. In recognition of this growing trend, the District started a compensation program in 2013. Between the program's inception and 2017, overall carnivore-derived cattle mortality ranged from 0.18 to 1.18 percent between 2013 and 2017 (Table 2). This

costs the District an average of $2,760 a year in livestock compensation, and $19,319 total (Table 3). Tenants reported livestock harassment by groups of coyotes, but none was able to quantify the costs incurred (Supplementary Material Tenant_Survey). Some mentioned that they thought stress, failure to gain weight, and failure to rebreed were likely costs. None of the tenants surveyed listed increased labor or preventative tools as added costs (Appendix 1 and Appendix 2 for additional information on mountain lion depredations in California).

Year	Stocking Rate	Animals Lost				Percent Lost
		Steer	Heifers	Calves	Total	
2013	237	2	0	0	2	0.84
2014	509	0	4	2	6	1.18
2015	575	0	0	4	4	0.70
2016	554	0	0	1	1	0.18
2017	563	0	0	2	2	0.36
2018	623	0	0	7	9	1.18
Total	3,175	2	4	18	24	0.72

Table 2: Reported cattle losses to confirmed carnivore depredations on Midpeninsula Regional Open Space District grazing allotments (Supporting document Grazing_Data.xlsx and Depredation 2013 to 2017.xlsx). The percent loss is expressed as the overall loss for the District. Individual livestock operation loss ranged from 0 to 6.98% of livestock managed. Of the 22 total confirmed losses reported between 2013 and 2018, 16 were determined to be from mountain lions, and 6 were lost to coyotes.

Year	Animals Reimbursed			Reimbursement Costs
	Steer	Heifers	Calves	
2013	2	0	0	$1,890.00
2014	0	***6***	2	$7,330.00
2015	0	***4***	4	$4,308.00
2016	0	***1***	1	$693.00
2017	0	***2***	2	$1,399.00
2018	0	**0**	7	$3,699.00
			Total	$19,319.00

Yearly Average	$2,760.00

Table 3: Confirmed depredation reimbursement costs from Midpeninsula Regional Open Space District paid to tenants for 2013 to 2018 (Supporting document Predation reimbursement.xlsx and Depredation 2013 to 2017.xlsx). Bold and italicized numbers include heifers that were killed as well as those who were not killed but did lose their calves. As such, rent for heifers that lost calves was expunged.

While Tables 2 and 3 account for livestock killed by carnivores, harassment and injuries can bring about indirect costs such as failure to gain weight, spontaneous abortions, increased labor, and other expenses that are difficult to measure (Ramler et al. 2014). Data on livestock harassment and the resulting potential changes in stress, movement patterns, productivity, susceptibility to disease, etc. are poor and the overall picture is not well-understood (Ramler et al. 2014, Clark et al. 2017). Clark et al. (2017) found that cattle living in wolf country had shorter daily movement patterns than those living in wolf-free areas, but these results were not tied to any sort of fitness outcome. Other research found that wolf presence did not negatively impact cattle, however, they did find that the weight of calves living on ranches with a confirmed wolf depredation decreased by 3.5 percent, or 22 pounds, for that year (Ramler et al. 2014). This translated into an average of $6,679 loss across the 264-calf herd at the time of sale.

At this time, wolves are not an issue with which the District's producers need to be concerned, but there are no similar data available for cattle harassment by coyotes, bobcats, or mountain lions. One can imagine that wolves present a more extreme version of coyote damage, and this could provide a helpful context for anticipating potential damages on District properties.

The USDA (2015a) provides some data enumerating the cost of wounds dealt to cattle in California by carnivores. They estimate these costs at $550,000 for injured cattle and $571,000 for injured calves in California for 2015 (these estimates assume that the animals had no value after they were injured). Unfortunately, these costs are not broken down by carnivore species.

Impacts by Species

According to national data collected by the USDA (2015a), the four main carnivores discussed in this review can be ranked in order of potential negative impacts to cattle and calves as follows:

Coyotes >> Dogs > Mountain Lions > Bobcats

In California, where mountain lions are more common than in other parts of the country, the relative ranking changes slightly:

Coyotes > Mountain Lions > Dogs > Bobcats

According to the District's tenant survey, the ranking is as follows:

Mountain Lions > Coyotes > Dogs

Half of the tenants surveyed classified predation as a critically important management issue, two thirds ranked it as important, and the remaining tenant ranked predation as not important. Other than the producer who thought predation was not important, all of the tenants have had predation issues on leased land, and almost all of the conflict was with mountain lions. Some tenants felt that coyotes pose little threat to cattle unless they form packs, or attack young or sick calves. There was also concern expressed about the stress of coyotes harassing cattle. None of the District tenants surveyed gave accounts of incidents involving domestic dogs or bobcats.

Mountain Lions

The level of impact mountain lions have on livestock operations varies greatly depending on the habitat (open grassland, rugged mountains, etc.), livestock species (cattle, goats, or sheep), operation type (cow-calf, steer, etc.), and location (California, Iowa, Colorado, etc.). Accounting for less than 1 percent of cattle or calf deaths across the U. S., mountain lions do not appear to have a nationally significant impact on cattle operations (USDA 2015a). However, it is important to remember that mountain lions were extirpated from the Eastern U.S. and Midwest over a century ago; excluding livestock that do not live in mountain lion country will increase the percentage of cattle or calf deaths in this calculation considerably (Shaw et al. 1988, Cougar Network 2018).

In most western states with healthy mountain lion populations, cattle depredation is an infrequent issue. For example, mountain lion research conducted in Colorado found that with over 200 mountain lions collared, and ample cattle on open range, there was not a single incidence of loss to mountain lions between 2004 and 2013 (Logan, personal communication). In New Mexico, mountain lion researchers documented cattle, including newborn calves, and mountain lions sharing habitat without any cattle killed in 10 years of study (Logan and Sweanor 2001). In that area, herds were composed of cow-calf groups with few bulls.

However, research conducted in Arizona, where there is a more temperate climate and year-round grazing, found contrasting results. This work indicated that livestock operations with year-round grazing and early season calving may be more susceptible to depredations (Shaw et al. 1988) (For a chart of seasonal versus year-round grazers on District property, see Appendix 3). These data support observations on District properties were mountain lion depredations are the most common form of carnivore conflict and are the greatest concern with respect to depredation management (Supplemental Material Tenant_Survey).

Significant differences in mountain lion versus wolf hunting styles likely makes the indirect impacts mountain lions may have on livestock far lower than is the case with wolves. Wolves are cursorial predators, which means they use a prolonged chase that can last upwards of several miles to select and subdue their prey (Kauffman et al. 2007, Wikenros et al. 2009). Mountain lions, on the other hand, are ambush predators that rely on stealth and surprise to capture their prey (Williams et al. 2014). As such, mountain lions are much less likely to chase

or harass cattle and other livestock, and ranchers operating in mountain lion country are much less likely to suffer from these indirect predation costs.

Coyotes

Nationally, dogs and coyotes are responsible for more livestock depredations than all other carnivores combined (USDA 2015a, USDA 2015b). This elevated risk could be related to the fact that coyotes are also the most widely distributed carnivore in the U.S., so probability alone would work in their disfavor. That being said, coyotes can reach higher population densities than mountain lions, live in closer proximity to people, and make use of more marginal habitat, potentially putting them at greater odds with livestock (Fedriani et al. 2001, Gehrt et al. 2010). Though they tend to pose a more substantial risk to sheep and goats, among carnivore-derived mortality across the U.S. in 2015, coyotes accounted for the highest percentage of cattle (40.5 percent) and calf (53.1 percent) depredations (USDA 2015a). Coyotes present a higher danger to newborns, sick calves, and cows giving birth than to adult cattle, and tend to be more lethal to dairy calves than to beef calves (USDA 2015a). There are numerous mentions of coyotes harassing and/or injuring cattle in scientific literature, however, data on rates, impacts, and associated costs are scant (Dorrance 1982, Jones 1987, Shwiff et al. 2016, Larson 2018).

The size difference between cattle and coyotes may work in cattle's favor. Cattle often stand their ground and may even cooperatively charge coyotes threatening their calves. This type of aggressive behavior may also deter further harassment. In some situations, cattle have been added to groups of sheep to protect them against coyote predation (Hulet 1987).

Domestic Dogs

In some geographic locations, domestic dogs may pose a significant risk to livestock. In 2015, dogs were responsible for 11.3 percent of cattle and 6.6 percent of calf losses to predation, and in 2014, dogs were responsible for 21.4 percent of sheep and 10.3 percent of lamb depredations across the U.S. (USDA 2015a, USDA 2015b). Direct as well as indirect impacts on livestock by dogs can be significant, and in some areas, greater than other sources of predation (Young et al. 2011). Even when dogs fail to kill livestock, they can injure or persistently worry animals. Dog depredation or harassment is generally more of an issue on the urban-wildland interface, making it a potential concern for the District. Domestic dogs guilty of livestock harassment or depredation are often friendly to humans, increasing the difficult of determining the culprit. Further interfering with a proper identification, dogs can deliver injuries difficult to distinguish from other predators, and may participate in "excess killing" where multiple animals are injured or killed and not consumed (Jennens 1998). One study found that free-roaming domestic dogs consumed, and likely killed, more livestock than local wolves (Echegaray and Vilà 2010). In addition, dog predation may be a growing concern; California producers anecdotally report an increase in free-ranging dogs associated with marijuana production in some regions (Macon et al. 2017). Though dogs are not currently allowed on any of the preserves that have cattle, this could also be a future concern as this policy may change in the coming years.

Bobcats

Bobcats pose little threat to large livestock, especially cattle. As such, it is likely unnecessary to put specific animal husbandry practices in place to protect cattle or any other large livestock from bobcat depredations or even injury. In 2015, bobcat and lynx predation combined accounted for 1.4 percent of beef cattle predation losses nationally, and 0.0 percent in California (USDA 2015a). In 2014, bobcat and lynx predation accounted for 0.11 percent of lost lamb, and 0.2 percent of adult sheep crop nationally, and 0.0 percent in California (USDA 2015b). Other studies found that bobcats may scavenge livestock carcasses, but are unlikely to be responsible for killing any large livestock, such as cattle, sheep, or equines (Neale et al. 1998, Scasta et al. 2002). They may take smaller animals, such as chickens, turkeys, fowl, or piglets. These sentiments were shared by the District livestock operators surveyed, who said that bobcats may eat chickens, but were not considered a threat to cattle (Supplementary Material Tenant_Survey).

IV. Local Indemnification and Depredation Prevention Programs

Most local land management agencies do not have formal depredation prevention or response policies. For many of these agencies, depredations do not pose a significant challenge, allowing them to handle each depredation on case-by-case basis (e.g. EBMUD and NPS). For example, Point Reyes National Seashore and the Golden Gate National Recreation Area, operated by NPS, have had very little depredation pressure and have been able to deal with incidents as they arise. Others, on the other hand, have had significant depredation challenges and have designed policies to help support local livestock operators. Marin County implemented the most formal of these policies, a depredation prevention and indemnification program called the Marin County Livestock Protection Cost-Share and Livestock Loss Compensation Programs. This program compensated livestock operators for losses to carnivores and helps cost-share preventative tools for livestock protection.

National Park Service Point Reyes (NPS) Livestock Grazing

NPS operates 28,000 acres of rangeland with around 6,000 head of cattle run by 24 ranching families (six dairy operations and 18 beef), and a couple other smaller sheep and chicken operations in Marin County. Ranch size ranges from 30 to 35 head on 230 to 330 acres to 856 head on 1076 acres. There are bobcats, coyotes, and mountain lions in the area, but depredation has not been a significant issue in the recent past. Since 2011, there have been fewer than a dozen reported depredations. In each of these instances, coyotes took beef calves that had wandered away from the herd. There was one case that may have been a mountain lion, but the parties involved were unable to confirm the species of carnivore involved. Lethal removal is usually reserved for animals that pose an immediate human safety risk, rather than for depredation, and no animals have been lethally removed for livestock depredations since before 1997.

On these NPS lands, federal law supersedes state law, so CDFW does not have jurisdiction and the depredation policies governing the rest of California are not applicable. Incidents are reported to NPS and a course of action is decided for each individual situation. Any preventative tool is subject to review by NPS before it can be implemented. Livestock guarding dogs have been approved for one small sheep operation and one chicken operation. None of the other operations are currently utilizing any approved depredation prevention techniques, but NPS would consider other alternative tools, such as frightening devices, or livestock guarding donkeys or llamas.

The NPS Management Policies (2006) state, "native predators, scavengers and prey are all integral to healthy native ecosystems and are protected by NPS Management Policies. The occasional damage that is caused by wildlife, to fences, ranching structures, agricultural animals and livestock forage, is to be expected on permitted lands. Lessee shall not engage in any activity that causes harm to or destroys any wildlife. Conversely, Lessee shall not engage in any activity that purposely supports or increases populations of non-native or invasive animal species. On a case-by-case basis, the Lessor will evaluate incidences of depredation and choose a course of action. The nature of the course of action taken, if any, will be determined by the wildlife species, the extent and frequency of the damage and park-wide management objectives." On Point Reyes National Seashore and the Golden Gate National Recreation Area properties, ranchers are indirectly compensated for any predation costs they may incur by offering a reduced grazing fee of $7.00 per AUM. This reduced cost takes into account the overarching principle that local ranchers are operating under strict NPS guidelines and are not able to manage their operations with as much flexibly as they could under other land designations (Press, personal communication).

Local Compensation and Depredation Prevention – Marin County Program (MCP)

The Marin County Program was one generally focused on sheep depredations, however, the principles and structures may serve as a model for a program geared toward cattle or livestock more broadly. Before 1999, Marin County was spending $60,000 each year on lethal coyote control, however, livestock (mostly sheep) losses were still a regular occurrence (Agocs 2007). In 2001, the County decided to discontinue its contract with Wildlife Services (WS) and replaced it with a county-run preventative program originally designated the Marin County Strategic Plan for Protection of Livestock and Wildlife. The WS federal trapping program was phased out, however, the new program did not impede ranchers from lethally removing carnivores from their own property. Slated to run for a five-year pilot period, the program redirected county funding that would have supported USDA trappers into assistance for ranchers implementing non-lethal carnivore deterrent tools, such as livestock guarding dogs, fencing improvements, birthing sheds, etc. When the pilot program ended in 2005, the County shifted to approving funding on an annual basis, and now the MCP has become an established county program. Each year, the Marin County Department of Agriculture conducts a meeting with

ranchers to evaluate the program and to solicit recommended changes to program operations (Larson 2006, Fox 2008).

Indemnification Program Overview

The original county-run program design did not include an indemnification program, but one was added at the request of the local ranching community. In order to receive compensation for depredations, ranchers were required to be an active participant in the proactive cost-share predation prevention program and to have at least two non-lethal livestock predation deterrents in place. These deterrents were verified and documented during an onsite ranch visit by the County Agricultural Commissioner's office. Once a ranch has been deemed qualified for indemnification, any losses suffered from that date on are eligible for compensation. When losses occurred, livestock operators needed to report losses to the Marin County Agricultural Commissioner's office by telephone, as well as to the University of California Cooperative Extension (UCCE) through a monthly mailed "livestock loss" card. UCCE provided third party loss verification and maintained a central database for depredation records. When necessary, onsite verification visits were performed by the Marin County Agricultural Commissioner's office (Larson 2006, Fox 2008).

Depredation compensation payments were made for each animal based on market value (calculated on a 3-year average of market rates for lamb at a weight of *ca.* 100 lbs.), up to $2,000 per year for ranchers managing operations larger than 200 head, and up to $500 per year for ranchers managing fewer than 200 head. Operations below 200 head were not considered commercial and were ineligible to participate in the MCP. In addition, show animals and special breeding stock were not eligible for indemnification. Confirmed depredation payments were made twice a year, once in June and once in December, through the Marin County Agricultural Commissioner's office. If the cumulative market value for the animals lost that year exceeds the available funds, compensation payments were prorated. At the end of each year, ranchers were required to sign an affidavit verifying their livestock loss claims (Larson 2006, Fox 2008).

Cost-Share Program Overview

The initial proposal was to have cost-share funds administered by a third party, such as the California Woolgrowers Association. However, after meeting with local livestock operators, it was decided that Marin County Agricultural Commissioner's office would administer the program. The MCP was designed in collaboration with ranchers, the Agricultural Commissioner's office, and the Farm Advisors office. Projects eligible for cost-share reimbursement were any material or property improvements that deter depredation, such as fencing, barriers, and birthing sheds; as well as animal husbandry strategies such as shepherding, penning, livestock guardian animals, noisemakers, and any other non-lethal carnivore protection measures or animal husbandry practices (Larson 2006, Fox 2008).

To submit a reimbursement claim, livestock operators needed to complete a form documenting the specific activity employed, and the costs for which funds were being requested.

Ranchers were required to contact the Agricultural Commissioner's office and set up an on-site review to be conducted by either the Agricultural Commissioner's staff or the Cooperative Extension's local Livestock and Range Management Advisor. After the activities were verified, the County Inspector and/or the Livestock Advisor would submit the claim to the Agricultural Commissioner for review. Once approved, an invoice for the amount of the claim would be submitted to the Treasurer's office and a check in the name of the respective rancher was issued. Once a year, a County Inspector or the Livestock Advisor would visit each participating ranch to verify that subsidized predation deterrents were in place, as well as make recommendations for additional potential deterrents or animal husbandry practices (Larson 2006, Fox 2008).

The most common purchases that the program helped cost-share were fences (electric, patch, and cross fencing), livestock guardian animals (dogs and llamas), and protective pasture corrals. Ranchers utilizing guardian animals were eligible to receive $250 to help defray animal maintenance costs, such as vet bills and food. This $250 pool of funding for animal care counted towards the cap set for that livestock operation size ($2,000 for operations greater than 200 head and $500 for operations smaller than 200 head) (Larson 2006, Fox 2008).

Outcome

Nearly all of the commercial sheep operations in the region participated in the MCP (Fox 2008), however, by 2009 program officials decided that the benefits provided by the indemnification program were outweighed by the implementation cost. The compensation portion of the MCP was terminated, and funds were redirected to support cost-sharing preventative tools such as fencing improvements, shepherding, changes in animal husbandry, livestock guarding animals, etc.

Overall, this program has increased the use of non-lethal deterrents, reduced depredations, reduced lethal removal, and increased support for preventative tools (Fox 2008). A study on the program indicated that livestock losses decreased by over 25%, while program costs were reduced by nearly 20% per year (Agocs 2007, Fox 2008). Participating livestock operators indicated that they were with the MCP, with most ranchers reporting a high degree of satisfaction with the program's level of cost-sharing and depredation compensation rate. In addition, overall lethal carnivore removal decreased by over 50% (Fox 2008).

Key Points to Consider

As the MCP ultimately found, compensation schemes can be very expensive and difficult to administer. In many cases, locating dead livestock and having them inspected in the timeframe required for positive verification can be incredibly difficult (Linnell and Brøseth 2003). Some research goes so far as to suggest that compensation schemes may be counterproductive, rewarding passivity and failing to motivate producers to adopt effective mitigation strategies (Boitani et al. 2010). There are, however, ways to overcome some of these issues, such as attaching conditions on the payments (e.g. setting minimum husbandry requirements, or stepwise payments scaled to the level of preventative measures in place), cost-sharing, or compensating producers for carnivore presence rather than depredations. This last approach of conservation performance payment scheme could help encourage producers to adopt

carnivore-compatible husbandry practices by incentivizing coexistence. In this type of system, financial incentives reward stewardship that allows livestock and carnivores share habitat; the payments offset the risk, as well as the indirect impacts carnivores impose on livestock (see "Direct and Indirect Predation Impacts" above) rather than paying for difficult to measure damages after they are incurred. The main requirements for a payment-for-presence system are that the parties involved agree on a fair rate of payment, fiscal support for the payments is secured, and a system is put in place to accurately document carnivore activity.[2] In addition to promoting coexistence, a payment-for-presence program would support monitoring native wildlife on District properties, an outcome aligned with the District's mission.

V. Conflict Prevention Tools

Creating and maintaining a livestock operation in which livestock and carnivores may flourish is an iterative and dynamic process. It will involve producers leveraging intimate familiarity with their particular operation to select appropriate preventative tools, and adaptively managing their practice as new situations arise. There are many different strategies and tools available to help livestock operators protect their livestock and coexist with carnivores. These tools can work on one or more pathways by altering human behavior, carnivore behavior, and/or livestock husbandry practices (Shivik 2004). A lack of consensus on when a particular tool or set of tools will be most effective makes it difficult to determine when to use which approach. The practicality and efficacy of any particular tool will depend on the type of operation, livestock species and products being produced, topography, carnivore community, native ungulate community, producer familiarity with and confidence in a given tool, associated cost-benefit considerations, public perception, and many other factors (Miller et al. 2016, Eklund et al. 2017). For a summary table of tool efficacy for each carnivore species, see Appendix 4. Every ranch is different, and local producers must weigh a unique set of site-specific considerations when

[2] In order to create a successful conservation performance payment program, administrates must first select indicators of carnivore presence, decide how these indicators will be monitored, and determine how the monitoring results will be used to inform compensation payments. Other programs have used the presence of carnivore offspring as the indicator for carnivore presence (Zabel and Holm-Müller 2008), however, depending on the monitoring technique, it may prove logistically simpler to use any age individual. Carnivore presence could be monitored indirectly via camera traps or scats (e.g. surveys, such as in Gese 2001; or genotyping scats, such as in Prugh et al. 2005), or directly through mark-recapture (review in Gese 2001). For a review of monitoring methods, see Gese 2001 or Gompper et al. 2006. The amount of payment should be calculated by the monetary damage the offspring are expected to cause over the course of their life. Because depredation rates on District properties are relatively low, this calculated amount could be too small for a pay-for-presence program to be attractive to tenants. Benefits to a pay-for-presence program include compensating livestock producers for hard to document costs, such as livestock harassment; removing the burden of searching for animals killed by carnivores in the timeframe necessary for validation; removing the administrative burden of verifying predation events; eliminating potentially contentious verification events in which trust between producers and administrators may be eroded. The largest benefit this type of program creates is that it provides producers with a higher incentive to both keep carnivores alive, and to be proactive about protecting livestock.

selecting appropriate tools. It is also important to recognize that every producer has a unique perspective and set of experiences that make some tools more palatable than others.

Ultimately, the most reliably effective protection will likely come from applying multiple tools (Koehler et al. 1990, Shivik 2006, Miller et al. 2016, Stone et al. 2017). Carnivores are smart, adaptive, and have a great deal of motivation and time to dedicate to finding prey. The more impediments livestock producers can provide, the more incentive there will be for carnivores to hunt native prey instead of livestock. The tools that follow are potential options to consider; clearly not every tool will be practical or suitable to every operation.

Lethal Control

Improving animal husbandry practices can reduce carnivore predation on livestock, but there are certain situations in which lethal removal of habitual problem animals may be the most appropriate course of action. There are two forms of lethal control - indiscriminate hunting and targeted removal. Indiscriminate control operates on the principle that decreasing the overall carnivore populations reduces encounters between livestock and carnivores, making it less likely for negative interactions. This approach seldom reduces conflict and can actually increase depredations (Shaw et al. 1988, Conner et al. 1998, Harper et al. 2008, Peebles et al. 2013, Wielgus and Peebles 2014). Centuries of lethal control on coyotes (hunting, trapping, and bounties) have had little impact on coyote cattle depredations unless the population is reduced by greater than 75 percent each year (Connolly and Longhurst 1975, Boggess et al. 1978). Increasing mountain lion hunting quotas may cause nuisance complaints and livestock depredations to *increase* by 36 to 240 percent (Peebles et al. 2013), as hunting removes territory-holding adults and disrupts social structure. When a resident male is removed, his territory becomes vacant. Multiple males may disperse into that vacancy and compete for exclusive rights to the area, a process that may locally increase the mountain lion population until the territorial boundaries are resettled. Further exacerbating the situation, the open territory makes space for young dispersal-aged males (Lambert et al. 2006), a demographic more likely to run into conflict with people (Peebles et al. 2013). A similar pattern could occur in areas where there is heavy poaching or lethal removals under depredation permits.

Selective, targeted removal may be a more effective option. For this tool to be applied appropriately, certain criteria should be met to ensure that the tool is being used effectively, namely that 1) an individual is a repeat offender, and 2) the correct individual is targeted. Most carnivores will take easy to kill prey, such as livestock, when given the opportunity. In some situations, producers may experience "excess killing," when a carnivore kills more prey than it can practically consume in one night. This is certainly very upsetting and costly to the producer, however, it does not necessarily indicate the presence of a problem animal. Carnivores evolved to eat prey that can potentially escape, but when livestock are corralled or penned, they cannot retreat to safety. In this situation, the carnivore is presented with a novel situation far beyond the context in which it evolved. Natural carnivore behavior, pursuing and killing prey, in this scenario can result in killing an unnaturally high number of animals, as multiple confined

animals repeatedly trigger a predatory response from the carnivore. It is a mismatch between the context in which the carnivore evolved over millennia (available prey is dispersed and able to flee), and the context in which it now lives (livestock have lost some antipredator behaviors and are confined in relatively high numbers). The behavior is problematic, but it does not mean is that the individual itself is necessarily predisposed to causing further conflict (Linnell 1999). A carnivore exhibiting this natural behavior does not indicate the presence of a problem animal, instead it indicates the presence of a novel situation and highlights the importance of proper penning, fencing, and other animal husbandry practices needed to protect livestock.

A problem individual is one that has developed specialized skills that allows it to seek out and access well protected livestock, and the individual has demonstrated this ability on multiple occasions, especially when appropriate protective animal husbandry practices have been put into place. If lethal control is deemed appropriate for such a case, that specific animal needs to be properly identified and targeted appropriately. Neither mountain lions nor coyotes have spots, stripes, or other markings that facilitate individual identification. In addition, their population densities are high enough in the Central Coast that there are likely a few members of each species that occupy any given location. This makes targeting the appropriate perpetrator very difficult unless it is caught in the act. The following section on "Identifying Recidivists" explores tools for distinguishing individuals.

When the targeted individual is successfully removed, this can lead to a temporary reduction in depredations. Targeted removal outcomes practiced on coyotes were improved when the breeding individuals of the territory in which that depredation occurred were killed (Eklund et al. 2017). However, in most cases, without further changes in animal husbandry practices, further depredations are likely to occur (Linnell et al. 1996). Ultimately, the conflict is most often created by placing attractive and easy to kill prey in habitat occupied by opportunistic carnivores. An additional consideration, removing a specifically targeted individual can produce the same dynamics that occur when there is carnivore hunting – that is, when a territorial individual is removed, multiple young individuals may move in to fill the vacancy and cause additional conflicts.

As discussed above, carnivores play an important role in maintaining a healthy and balanced ecosystem, however, lethally removing a single individual carnivore in a stable population is unlikely to have a significant impact on the overall long-term ecosystem viability. In contrast, in systems where there are several threatening forces, such as habitat degradation, loss of connectivity, rodenticides or other environmental toxins, etc., the larger the impact will be for each individual removed. This is the case in the Santa Monica Mountains and the Santa Ana Mountains in Southern California. Urbanization, isolation, and lack of connectivity have driven what used to be thriving mountain lion population to the brink of local extinction (Ernest et al. 2014, Benson et al. 2016). In these two areas, livestock producers experiencing livestock or companion animal losses are given more extensive help in preventing further conflict before being issued lethal take permits only when a total of three depredation events occur.

Identifying Recidivists

In order to employ targeted lethal removal, it is necessary to be able to identify individual carnivores, determine that there is a behavioral pattern, and select that individual for intervention. It can be very difficult to identify individual members of a species that lacks unique features (such as coyotes and mountain lions), however, researchers have developed some methods that can facilitate this process. There are two main alternative pathways for identifying individuals; methods that allow remote identification in real time, and methods that enable identification after the fact.

Marks, Tags, and Collars

One set of tools for identifying animals in real time is to capture the offending animal and mark it with a collar, unique ear tag, or unique dye marking. These three strategies allow anyone observing the animal, be it through direct observation or via camera traps or other indirect means, to identify the individual. In order to employ these strategies, the animal must first be captured using CDFW-approved protocols, then processed by trained personnel that can safely set and monitor traps, as well as immobilize, handle, and release the animal.

Capturing animals is a resource intensive process, and is frequently unsuccessful. Cage traps set for mountain lions must be monitored every 20 minutes from the time they are opened at sunset, until an animal is caught or until they are closed (usually at sunrise). If trailing hounds are used, it requires specially trained dogs, the dog handler, and the gear and personnel for darting, extracting, and handling the mountain lion. Most hound capture days require long hours, often starting before sunrise and ending around dark. When trapping bobcats or coyotes, the process is much simpler and less time intensive, as the traps do not usually require as frequent monitoring, but it still make take many capture attempts before an animal is trapped. Capture success will be greatest if the animal is targeted soon after the depredation event; odds of capturing the offending individual drop significantly with each night that passes after the incident. Any area where trapping is being conducted should be closed to the public to avoid tampering with traps or trapped animals, driving wildlife away from traps, accidentally trapping pets, etc. The traps permitted by CDFW for capturing mountain lions, bobcats, or coyotes tend to be fairly selective when used properly, however, protocols should be in place for even occasional non-target capture situations. Some species may be safely handled without chemical immobilization, such as coyotes, while others need to be tranquilized, such as mountain lions and bobcats.

With a trapped animal in hand, it can be marked with a unique ear tag or fur dye that will allow it to be identified from a distance. Fur dye is a technique commonly used in species monitoring in which a unique marking is dyed onto an animal's fur, providing a large, easily visible, distinct identity that will last up to several months, depending on the type of dye, the environment, hair shedding schedule, etc. This method can be deployed quickly and inexpensively, and it is minimally invasive. Ear tags provide a permanent identification that is also commonly used in wildlife monitoring. It is marginally more invasive, provides a longer lasting mark, but care must be paid to other tags in the area to make sure that similar ear tags are

not deployed in overlapping territories. Though the tags often have a unique number printed on the tag itself, these number are often not visible from afar, so it may be necessary to use color, shape, and other features to distinguish between tags. If ear tags are not placed properly, they can tear out, injuring the animal and making it difficult to identify that individual.

Tracking collars are the most invasive of these tools, impose the greatest risk of injury to the animal, but they also provide the greatest amount of information about the animal and its habits. There is a wide range in collar types; more basic collars emit a high frequency radio signal that can be monitored with a handheld telemetry receiver, while others collect real time tracking data that can be monitored remotely. There are a corresponding variety of collar prices ranging from a couple hundred dollars to a few thousand dollars, depending on the features required. Collar battery life can last up to a couple years before the collar needs to be replaced, however, this timeline is highly dependent on the features being used and the size of the battery deployed; higher GPS acquisition rates and other energy intensive features dramatically shorten battery life. Fitting the collar properly is extremely important and should only be performed by trained personnel, as an ill-fitting collar can easily kill the animal that is wearing it.

In addition to being useful as a way to identify individuals, tracking collars can also be used as a preventative tool. High-end collars can be set to send an email alert when the animal wearing it enters a user-determined area, such as a particular pasture, allowing producers to proactively manage their livestock and respond to a potential threat. This is most useful when a high portion of the local carnivore community is collared; in places where only a small fraction of the carnivores are collared it could provide a false sense of security when a known collared animal is not in the area, and potentially encourage practices that leave livestock vulnerable to predation from unmarked carnivores.

Biopsy Darts and Environmental DNA

Another set of tools make it possible to identify individual carnivores by their unique genetic signature, either through sampling it from the animal directly (as in the case with biopsy darting), or by collecting it from the environment. Whichever the method used, nuclear DNA extracted and the genetic sequence contained within the sample provides a unique identity that may be compared to other samples to find matches.

If the genetic material is collected via a biopsy dart, the animal must first be captured, treed, or located in another situation in which it can be safely shot with a collection dart. It is more common to use this tool on bears or mountain lions and less common with bobcats and coyotes. When used with mountain lions, the most common method is to tree the individual with trailing hounds and then shoot it with a sampling dart once it is stationary in a tree. The dart itself is outfitted with a sharp sampling tip that extracts a small flesh punch and falls off after impact. The dart is recovered by tracking a small telemetry beacon in the base of the dart, or by finding it visually.

A variation on traditional biopsy darts is a blunt dart outfitted with sticky tape that collects a small number of hairs on impact (method described in detail in Valderrama et al.

1999). Biopsy darts are somewhat invasive, whereas the sticky dart is far less so. In either case, it is important for the animal to be stationary and oriented such that the person collecting the sample can get a clear shot at the animal's its caudal thigh, and that the dart gun is set for an appropriate pressure level; a poorly placed dart or a dart gun that is firing with too much force can turn a nonlethal projectile into a lethal one.

Collecting DNA from the environment is completely noninvasive; does not require the animal to be trapped, treed or stationary; and can be applied to any species. However, it can also be difficult to get high quality samples suitable for analysis. Usually DNA is collected from hair or scats, but it is possible to sample urine, shed skin, or saliva as well. Scats and carnivore hair often remain at kill sites and may be collected for analysis. The genetic material in hair is found in the follicle at the base of the hair. Several hairs with the follicle present are required for analysis; the greater the number of hairs available, the higher the chance of a successful analysis. Fecal DNA is collected from the outside of the scat where there are shed intestinal epithelial cells from the scat producer. There is also DNA from the prey, but there are methods for determining which DNA belongs to the scat producer. Saliva is also proving to be a successful sample material and can be collected from wounds left on the deceased animal. It is important to sample from hemorrhagic wounds, as those will reflect injuries inflicted when the animal was still alive rather than bites taken after the carcass was potentially scavenged by other carnivores (methods described in Mumma et al. 2013).

Regardless of the material used, there are a number of considerations that must be taken into account while designing data collection protocols and post processing. For example, the biologist needs to determine the number of microsatellites (short, repeated DNA sequences) necessary to be able to distinguish individuals. This number will depend on how closely related individuals are, how many individuals will be sampled, etc. In addition, how the sample is handled and stored will have a large impact on whether the sample can be successfully analyzed (specific methods are reviewed in Waits and Paetkau 2005).

Genetic tools are powerful, but implementation hurdles limit their practical utility. Genetic sampling is relatively new and growing field, and lab spaces set up to analyze genetic samples for outside entities are limited, expensive, and can take a long time for processing. Much of the current work currently conducted using eDNA occurs at university labs where the focus is on research. This tool could become more accessible to the District if the data were to align with lab research objectives, but as a management tool there are many logistical constraints.

Fencing

Separating livestock and wildlife with fencing has been one of the most common practices since livestock were first domesticated. Fences can provide protective physical barriers, psychological barriers (such as by delivering an unpleasant shock), or both. As is the case with other tools, practical considerations, such as habitat type, pasture size, livestock species and number, carnivore community, native ungulate community, topography, etc., are

especially influential in determining which type of fencing is most feasible and effective. Additional regulatory constraints, constructions and maintenance costs, etc. will further restrict fencing options. An important point to keep in mind is that nearly any fence that will successfully exclude carnivores will exclude other non-avian wildlife as well. This tool could be in conflict with District fencing guidelines that deem wildlife passage a high priority. Fencing capable of hindering carnivores will likely be most useful at a small spatial scale, so as to avoid obstructing local wildlife from utilizing large swaths of habitat on District land.

Most research to date has evaluated the efficacy of using fencing to prevent coyote and dog depredation (Thompson 1976, Gates et al. 1978, Wade 1982, Acorn and Dorrance 1994). Little work has been conducted to determine proper fence construction for excluding mountain lions (Linnell et al. 1996). Fencing is likely best employed in combination with other tools, however, if producers wish to use fencing as a standalone tool, they may find it to be most successful and cost-effective for preventing canid entry on small pastures with flat and relatively open habitat (Macon et al. 2017). Mountain lions are skilled climbers; they can scale nearly any type of fence practical for use in a livestock operation. Most electric fences are not high enough to be an effective tool for excluding mountain lions.

Fencing to exclude carnivores is likely an option best suited to small-scale use. Any fence appropriate for blocking carnivore passage will likely be effective at excluding other wildlife, which runs counter to the District's mission. Producers and the District must carefully weigh the tradeoff between the level of protection afforded by fencing and the cost of effectively losing that area as wildlife habitat. Impacts to non-target wildlife may be minimized by making sure that fences are well maintained, wires are kept taught, the top of the fence is clearly visible (fladry or flags may be used to increase visibility), installing sections of lay-down fence in seasonal pastures for when they are not in use, and that appropriate materials are used for game trails and other areas of high wildlife activity. However, any concessions afforded to other species will likely make it easier for carnivores to cross the fence line as well.

Permanent Wire Fencing

As a physical barrier, conventional 5- or 6-strand barbed wire fences may be effective at confining cattle to a pasture, but coyotes, dogs, and mountain lions can generally penetrate this type of fence. Many producers prefer permanent steel-wire net fences. An adult coyote can climb fences less than 66 inches high, and can fit through openings greater than 4 inches by 6 inches (Thompson 1976, Linnell et al. 1996). Combining conventional woven wire fencing outfitted with an electrified top strand to prevent climbing, or adding an exterior tripwire makes them more effective than traditional fencing alone (Gates et al. 1978; Acorn and Dorrance 1994). Coyotes are expert diggers; placing a barbed wire at ground level or using a buried wire apron can discourage this. However, these additional features can become expensive, even for small pastures. Such elaborate fencing materials tend to be expensive and may be best used in calving areas or other places where calves may be vulnerable to coyote and dog predation.

Permanent Electric Fencing

Depending on the type of fence used, this tool can provide livestock and carnivores with a physical and/or psychological barrier. These fences provide an unpleasant stimulus that is uncomfortable, but ultimately not actually harmful to livestock or wildlife. The number of wires required and voltage depends on the carnivore species the producer wishes to exclude. For coyotes, there are a few designs that are considered effective. Twelve-strand smooth wire fences with alternating hot and ground with an external electrified trip wire were deemed "coyote proof" (Gates et al. 1978). Similarly, 9-strand high-tensile smooth wires with alternating hot and ground were also deemed effective options (Acorn and Dorrance 1994). In either design, the bottom strand should be hot and placed no higher than 5 inches above the ground to ensure that a coyote attempting to dig beneath the fence will receive a shock (Acorn and Dorrance 1995). As vegetation allows, the lower the bottom hot wire can be, the better it will be for preventing digging. This type of fence can be difficult in rugged terrain, as it can be difficult to maintain tension on the wires to make sure they do not touch, and ensuring that wires are close enough together such that a coyote could gain entry. For any electric fence, reducing the spacing between wires and increasing the number of wires will make it more effective and also more expensive.

The most frequent problems encountered with permanent electric fences are 1) inadequate grounding, 2) the bottom hot wire is too high above ground level (>5 inches) to prevent coyotes from digging beneath the fence, 3) wires spaced more than 6 inches apart, 4) inadequate vegetation control causing short-circuiting, 5) issues with the energizer (Acorn and Dorrance 1995; Macon, personal communication). Dry soil conditions can also decrease electric fence efficacy.

Temporary Electric Fencing

Temporary electric fencing is a more common practice in sheep and goat husbandry than it is for cattle. Most temporary electric fences are constructed from strands of poly-wire or tape woven with steel wire to conduct electricity. As a part physical, part psychological barrier, it is important to train cattle before they will respect the boundary. Introducing large livestock to the fence in a damp area or after wetting the paddock soil can make training bouts more effective. In addition, cattle and horses have a more difficult time recognizing thin wire as a barrier; producers may increase their success by using electric tape as a visual cue (Macon, personal communication). These fences tend to have a shorter expected lifespan (3 to 7 years) than permanent fencing, however, upfront costs and construction tend to be much lower (Macon et al. 2017). To reduce labor, producers may set the ground rods strategically so the rods stay put as paddocks are rotated.

Standard electronet fencing constructed 5 feet high can effectively deter coyote and dog predation, however, this is unlikely to be a helpful tool for producers operating on open rangeland (Larson and Salmon 1988, Linnell et al. 1996). This tool may be more suitable for protecting calving grounds or other areas where cattle (calf specifically) or other livestock use is concentrated. When used in a very small area where an intruding mountain lion is nearly certain

to make contact with the fence, this tool can be effective protection for any type of livestock (Cavalcanti et al. 2012). Research on specific fence designs for mountain lions is lacking, but some producers have had luck with two types of designs. The first is electronet with 3 wires, and an additional external trip wire set 3 to 4 feet away from the perimeter fence. The external wire cannot be set any closer than 3 feet or a mountain lion will be able to clear both fences without receiving a shock. Second is 8-foot fence with an overhanging hot wire on top (UCANR 2017). Mountain lions may be able to scale the fence, but this design is devised to deliver a discouraging shock when they reach the top. Keep in mind, these two designs have been recommended by livestock producers and have not been experimentally tested.

Fladry and Turbo Fladry

Originally developed to funnel quarry for hunting, fladry is a cord from which brightly colored strips of cloth or plastic flags hang at regular intervals and flap in the wind to create a displeasing novel visual stimulus. Turbo fladry has an electrified wire running through the cord with the goal of adding an additional unpleasant physical stimulus. Studied extensively with wolves, the efficacy of this psychological barrier for other species is low or remains to be studied (Musiani et al. 2003, Shivik 2003, Miller et al. 2016). Fladry and turbo fladry rely on wariness to be effective. Though wolves are deterred by these flags blowing in the wind, coyotes may be too curious for these tools to provide much of a deterrent (Musiani et al. 2003, Shivik 2003). Results from studies looking at coyote responses to fladry have provided mixed results (Musiani et al. 2003, Shivik 2003, Young et al. 2015). However, over time, even wolves habituate to fladry and turbo fladry, making this tool appropriate for small scale, short duration use at best (Linnell et al. 1996, Musiani et al. 2003, Shivik 2003). It appears that no studies to date have assessed the potential influence fladry or turbo fladry on mountain lions, domestic dogs, or bobcats.

Night Penning

One of the most consistently effective methods for protecting livestock from predation is housing them in a fully enclosed structure during times when predation is highest (Linnell et al. 1996, Miller et al. 2016, Eklund et al. 2017). This period could be when carnivores are most active (usually from dusk until dawn each day), or it could be a life stage when livestock are particularly vulnerable (such as lambing or calving). With proper construction, protective structures can be used for nearly any type of livestock and any type of carnivore (including humans). Different carnivore species require specific building considerations. For example, coyotes and other canids are capable diggers, so effective enclosures require a solid floor, placing a barbed wire at ground level, or a buried wire apron. Mountain lions, on the other hand, do not dig, but are expert climbers. Enclosures designed to protect against mountain lions must have a sturdy roof and any openings must be too small for a mountain lion to gain entry (4 inches by 6 inches at most).

When using night pens for a prolonged period of time or with a large number of livestock, sanitation becomes an important consideration. Livestock may need more frequent anti-parasite treatment and the enclosure will need regular cleaning (Linnell et al. 1996). Small ruminants in particular, are susceptible to orthopedic infections that may be exacerbated by being enclosed with conspecifics. One potential solution is to place a therapeutic footbath at the pen entryways so animals' feet are cleaned and treated as they enter the enclosure.

Some fear that enclosing livestock restricts their access to forage and will reduce their ability to adequately gain weight. Research conducted on cattle and sheep suggest that they compensate for lost grazing time and are able to gain weight as well as they would if left unconfined (Linnell et al. 1996). Night penning also permits daily contact and inspection of livestock.

Though enclosures can provide extremely effective protection, they are only suitable for small-scale operations in which a human can be present each morning and evening to let animals in and out. In the future, there may be technological tools available to operate enclosures automatically or remotely, but these tools are not currently commercially available. Night penning is likely the most effective option for District tenants with chickens, alpacas, horses, or other small-scale livestock operations; this is not likely a suitable tool for cattle producers on open range.

Livestock Guarding Animals (LGA)

One of the oldest practices in the livestock protection toolbox, livestock guardian animals make also be one of the best tools for keeping livestock safe and healthy. More common in sheep and goat operations, these animals may be used with cattle as well. Benefits to using LGAs may include reduction in predation and labor, as well as more efficient pasture use, potentially without displacing predation risk onto neighboring pastures (Linnell et al. 1996, Webber et al. 2012, Miller et al. 2016). Similar to deciding on appropriate fencing, LGAs come in a wide variety of species and breeds, and choosing the right type of guardian animal, and number needed, will depend on a variety of criteria, such as the size and type of livestock operation, terrain, level of use by the general public, carnivore species present, etc. The cost to acquire and maintain LGAs varies greatly by species and breed, and requires proper training and years of commitment from the producer. Since people started using LGAs, they have employed a wide variety of species such as dogs, llamas, cattle, ostriches, and even baboons (cited in Linnell et al. 1996). This review will focus on the three most common species in North America, dogs, llamas, and donkeys. Livestock guarding dogs are likely the most effective option for protecting against the carnivores present on District properties. Llamas and donkeys are usually less expensive to acquire and maintain, easier to train, and live longer than dogs, but they are not as effective at protecting against mountain lions (Linnell et al. 1996, Smith et al. 2000, Miller et al. 2016, Macon et al. 2017, Scasta et al. 2017). There is an extensive literature on training livestock guarding animals, breed selection, care, and maintenance, the details of which are beyond the scope of this review (see Smith et al. 2000, Dawydiak and Sims 2003).

Livestock Guarding Dogs (LGDs)

There are many breeds of livestock guarding dogs that have been developed over thousands of years of selective breeding. Though many more exist, commonly found breeds in North America include Great Pyrenees, Bernese Mountain Dog, Anatolian Shepherd, Komondor, Akbash, and Maremma (Linnell et al. 1996). Animal Plant Inspection Services in collaboration with Utah State University is currently conducting research to determine whether additional breeds developed in other countries, such as Kangal, Karakachan, and Cao de Gado Transmontano, may provide reliable carnivore protection while remaining safe for use on public lands that overlap with human recreation (Kinka, personal communication). Much of the research on LGDs has focused on protecting sheep, however this is a tool that has been successfully used with cattle and other livestock species as well.

Likely to be the most effective for District producers, however, LGDs are the most expensive LGA in time and money. In order for them to be effective, LGDs must be properly trained and strongly bonded to the herd. The average time spent supervising, training, and feeding averages 9 to 10 hours each month (cited in Smith et al. 2010). If they are improperly trained and treated as pets, "the only thing they will effectively guard is the front porch" (Macon, personal communication). Initial costs range from $240 to $1000 depending on age and breed, and first year costs of shipping, food, vet bills, travel, damages caused by dogs, etc. average $700 to $900. Subsequent mean annual expenses range from $250 to $290 (cited in Smith et al. 2010). Not all dogs are appropriate for the job, roughly a quarter of LGDs injure or kill the livestock they are protecting, making selecting the right individual important. However, LGDs are more commonly used with sheep and goats, which may be easier for the dogs to harm than cattle. Depending on their personality, guarding dogs should be temporarily removed when using shepherding dogs, as conflict between the two may arise.

If properly trained and bonded, LGDs can be highly effective, reducing depredations by up to 100% (Linnell et al. 1996, Gehring et al. 2010, Smith et al. 2010, Miller et al. 2016). They are among the most highly praised tool available. In a survey of 400 producers using over 700 dogs, 82% of respondents deemed dogs an "economic asset" and 9% ranked them as a "break even" investment, and the remaining 9% categorized them as lower value (cited in Smith et al. 2010). Compared with other preventative tools, LGDs are likely the most effective tool for operations ranging from a few animals in a small paddock to large herds on open range (cited in Macon et al. 2017).

LGDs are effective against felids as well as other canids. Properly trained LGDs with appropriate dispositions can also be effective against free-ranging dog depredations, a concern for producers operating on the urban-wildland interface (Larson and Salomon 1988). LGDs can help keep encourage herding behavior in livestock, making this tool especially effective for large-scale open range situations, and helpful to for gathering and moving livestock. In addition, LGDs disrupt a carnivore's behavior without displacing it. That is, the carnivore can still live alongside the livestock operation and maintain its territory, so protection of one pasture does not necessarily mean increased predation on a neighboring pasture or ranch (Coppinger et al. 1988).

In effect, an LGD can "train" the local carnivores to respect the boundary between the dog and the carnivore. Together, the LGD and the resident carnivore, in turn, defend that area from intrusion by other members of the carnivore's species (Macon, personal communication).

A major concern for livestock operators working on District properties would be how LGDs interact with park visitors and domestic dogs. Different breeds of dogs differ in their level of aggression toward people, as do individuals within a breed. LGDs intended for use on District land where they may encounter members of the public and their pets need to be carefully screened, as overly aggressive LGDs could pose a significant risk to the public as well as companion animals. Producers may wish to post signs alerting the public to LGD presence, and temporarily bar domestic dog access. In order to bolster support and compliance, it may be wise to include information on the proactive conflict prevention program, and provide information on how to handle potential interactions with LGDs. The USDA has produced informational material to help avoid conflict between recreationalists and LGDs (USDA 2010a, USDA 2010b). Before considering LGDs, it would be prudent to consult the District's legal counsel for advice on potential liability created by their presence.

Llamas

Llamas are a member of the South American camelid family that includes alpaca and others. Though some people use alpaca as LGAs as well, llamas tend to be more territorial and aggressive than alpaca, making them better suited to livestock protection (Linnell et al. 1996). Some llamas are naturally aggressive towards dogs and coyotes; however, they are not an effective tool against mountain lions. This feature likely makes them ill-suited for use by District producers, unless threats shift and District producers find a growing need to protect against domestic dog predation. In addition, there is scant information on using llamas for protecting cattle. All of the following information is from studies addressing llamas protecting sheep. These results may or may not be transferable to cattle.

Gelded males are most commonly used and can be purchased for $700 to $800. Maintenance costs are low, as they have similar dietary and management requirements to cattle (other than needing to be sheared) (Smith et al. 2010). There is virtually no need for training, as llamas usually assimilate to sheep herds within a couple of hours to one week, however data are not available for bonding time between llamas and other species of livestock. Llamas may work best in small- to mid-sized operations on pastures up to 300 acres. Average operators recommend one gelded male llama for 250 to 300 sheep; using more than one llama per group often results in the llamas bonding with one another rather than to the herd (Andelt 2004). When confronting a carnivore, typical behaviors include alarm calling; approaching; chasing, kicking, spitting; or positioning themselves between the carnivore and the herd. It is important to note, llama's aggression towards canids makes them incompatible with LGDs or shepherding dogs. Llama size and alertness are positively correlated with aggression, making large, alert llamas likely to be the best guardians (cited in Macon et al. 2017).

Donkeys

Similar to llamas, donkeys tend to be used for protecting sheep more often than for protecting cattle, and most of the literature pertains to the former. Again, the principles may or may not be transferable to cattle operations.

Donkeys are less expensive to purchase than LGDs or llamas (between $65 and $250), and inexpensive to maintain ($66 per year on average, with a range of $0 to $300) (Smith et al. 2010). The most common varieties of donkeys used are standard or mammoth. Single jennies or gelded males are most effective, and generally need to be introduced to the herd between 3 to 6 months of age. Herd bonding should be solidified for 4 to 6 weeks before donkeys are turned on pasture with livestock. They are longer lived than LGDs, with an average life expectancy of 10-20 years. Llamas and donkeys are compatible with other depredation prevention, livestock management tools (other than shepherding dogs), and are less likely to wander beyond fence lines than LGDs (cited in Macon et al. 2017).

Typical guarding behaviors include braying, running towards or chasing the intruding carnivore, biting, and kicking. Individual donkey personality and propensity for aggression toward canids vary greatly, so introducing a donkey to a dog to evaluate their reaction before relying on that animal to protect livestock would be wise (Smith et al. 2010). Donkeys that display aggressive behavior to carnivores are most effective at deterring coyotes and dogs in small (up to 600 acres), relatively open pastures (Macon et al. 2017). Donkeys are less effective against mountain lions than LGDs.

Some donkeys are aggressive towards lambs or kids, so caution should be used when calving. It is often ineffective to use donkeys in pastures adjacent to other donkeys, horses, or mules, as they may bond with their fellow equines rather than with the target herd. Donkeys have similar dietary requirements to cattle; however, it is critical that donkeys do not have access to feeds with ruminant-only feed additives (like Bovatec, Rumensin, and other ionophores), which are extremely toxic to all equines.

Frightening Deterrents

Various frightening devices, primarily visual and auditory, have been used to prevent livestock depredation. Some carnivore species tend to avoid novel stimuli, such as randomly flashing lights (eg. Foxlights), radios, propane cannons, etc. Very little is known about the effect of acoustic and visual deterrents on livestock predation by mountain lions or bobcats, however, some research suggests that randomly emitting strobe/siren devices may temporarily deter coyote depredation. In one study with fenced-pastured sheep, coyotes were deterred for up to 91 days and reduced lamb losses by 44 to 95 percent (Linhart 1984, Linhart et al. 1992, Linnell et al. 1996). In another, random strobe lights were found to be effective at reducing coyote predation on sheep by 60 percent for the 3 months they were deployed (cited in Linnell et al. 1996). The only study addressing the efficacy of flashing lights on preventing mountain lion depredation found Foxlights to be an effective deterrent for protecting camelid bed sites for up to 4 months (Ohrens et al. 2018). A study measuring the efficacy of timed gas exploders set to go off every 7 to 8 minutes from dusk until dawn found that they were effective against coyote predation for an

average of 31 days to 6 weeks before animals became habituated to the sounds (cited in Linnell et al. 1996). Acoustic devices alone seem to be less effective, but they have only been rigorously tested on bears (Miller et al. 2016). Unfortunately, there has been little rigorous testing of these methods, and the few studies that exist are often hampered by small sample sizes, poor experimental control, lack of strong inference, and limited ability to reliably inform management (Miller et al. 2016, Eklund et al. 2017, van Eeden et al. 2018).

Some tools are designed to emit an unpleasant stimulus at random intervals, while others are triggered by animal presence. Foxlights, Predator Guard, and other similar devices belong in the former group of tools that randomly emit bright, displeasing lights from sunset until sunrise when most carnivores are most active. Motion-activated sprinklers, lights, and sound devices, on the other hand, are only triggered when an animal is present. Each of these tools provides a psychological barrier by making the immediately surrounding area more unpredictable and frightening, however motion-sensitive sprinklers are the only tool that deliver a physical penalty for trespass, which could increase the amount of time it takes for carnivores to habituate to them.

While deterrent devices may provide some immediate short-term protection, animals may become habituated to these tools in a matter of days or weeks, depending on the species and context in which they are being used. When used alone, these tools are likely best suited for high-risk, short-duration, small-scale use, such as calving paddocks (Koehler et al. 1990, Linnell et al. 1996, Shivik 2006, Miller et al. 2016, Ohrens et al. 2018). Combining acoustic and visual techniques may enhance efficacy and increase the time before carnivores habituate (Koehler et al. 1990, Miller et al. 2016). Additionally, tools that are behaviorally triggered (i.e. motion-sensitive devices), or provide a physical penalty (eg. sprinklers) are more likely to remain effective for a longer period of time (Shivik and Martin 2001).

Changing Cattle Breed or Operation

Generations of breeding have selected for livestock with traits that decrease their ability to identify, respond to, and avoid predation threats (Johansson 2001, Price 1999, Muhly 2010). Behavioral traits, such as docility, and physical traits, such as exaggerated meat growth, leave livestock more vulnerable than their wild ancestors (Flörcke and Grandin 2013). Switching from a more docile breed to one better equipped to protect itself could help prevent depredations. For example, changing from a gentle breed, like Hereford cattle, to a more territorial one, such as Raramuri Criollo or San Martineros, could provide more robust stock (Shaw et al. 1988). The USFWS is currently experimenting with a mixed herd of traditional beef cattle and Raramuri Criollo cattle (11 cows and 1 bull) to test whether mixing in this species of cattle will result in fewer losses to federally endangered Florida panthers. This experiment has only been running for a short duration and it is too early to tell whether this will be a successful strategy (Lotz, personal communication). Similarly, San Martineros, a little-known subspecies of Criollo cattle that descended from Spanish fighting bulls, are being introduced to mixed herds in Columbia. This breed is reportedly docile with humans, but fiercely defensive of their young and territory, even against carnivores (Economist 2017, Hoogesteijn and Hoogesteijn 2014). Maintaining

docile temperaments in cattle ranging on land shared with the general public is likely an important factor to keep in mind on District property; there is an important balance to be struck between reducing the changes of livestock predation and increasing the chances that a member of the public could be hurt by cattle.

In addition to changing cattle breed, altering the type of operation can also shift the level of predation risk. Some demographics are more vulnerable than others (newborns, calves, females giving birth), and converting from a cow-calf operation to steer only could reduce depredations and be effective on any spatial scale (Shaw 1977, Shaw et al. 1988). The idea is to stock animals that are large enough to be able to escape predation, which means running only cattle that have reached 140kg or greater (Shaw 1977). Again, these considerations need to be weighed against producer preferences and public safety. Combining different livestock types (such as mixing cattle and sheep) may decrease risk as well, this may be especially beneficial for the smaller livestock (USDA 2015a).

Altering Pasture Vegetation and Grazing Regimes

Ideal carnivore hunting habitat is often determined by a combination of habitat type, topography, prey species habits, and hunting modality. Coursing predators, such as wolves, prefer open habitat where they can locate their prey and chase them for long distances, during which time they may select for weaker members of the herd (Kauffman et al. 2007). Ambush predators, such as mountain lions, rely on more heavily structured environments in which they may conceal their presence and pounce on their prey at close range (Williams et al. 2014). Altering pasture vegetation on a scale that would alter predator-prey dynamics between livestock and native carnivores likely falls outside the mission of the District, however, there are actions that could be taken on a small scale.

Rather than altering the pasture vegetation, producers can use vegetation as a guide for where and how to graze particular areas. Depredations may occur in particular "hot spots" where topography, vegetation, and animal behavior coincide to produce locations where livestock are more vulnerable (Jackson et al. 1996, Linnell et al. 1996, Miller et al. 2016). In the Santa Cruz Mountains, this is likely to be areas with rough terrain and shrubby vegetation. Oak savanna, grasslands, and other open habitats are likely to be safer areas for livestock (Yovovich 2016). Livestock producers may wish to select open habitats for calving and grazing cattle until they reach a size less vulnerable to predation (>140kg), and avoid grazing young calves in shrubby pastures where possible (Shaw 1977).

Mapping depredation occurrences to look for spatial patterns could help inform stocking decisions as well. Areas deemed higher risk could be avoided or stocked with a less vulnerable livestock demographic, or more aggressive breeds or individuals could help improve livestock safety. For example, if producers wish to graze in shrubby habitat, they could replace cow-calf pairs with bulls or individuals they know to be more aggressive.

Altering Production Calendar

Carnivores tend to optimally forage, selecting prey that is easiest to find and subdue (Lima and Dill 1990). Most carnivores will select newborns and young juveniles over adult members of the same species, as they are generally easier catch to subdue. In addition, many species have a seasonal birth pulse during which time there may be an abundance of young animals afoot. Livestock producers able to time their own calving to coincide with deer fawning can take advantage of easy alternative prey source that may draw mountain lions and coyotes away from livestock (Shaw 1977, Shaw 1981, Linnell et al. 1995, Sacks and Neale 2002). However, synchronizing livestock calving with deer fawning is a strategy better suited to livestock producers East of the Sierra crest were spring calving is common. Livestock producers seek to align the peak energetic demands of their cattle with peak forage production; livestock will certainly need good quality forage, while protection from predation is less definite. In Coastal California, taking advantage of the highest quality forage requires calving in the fall. Deer fawn in late spring to early summer (Bowyer 1991), making it difficult to synchronize ungulate fawning with calving.

While synchronizing calving and deer fawning may not be a suitable option for Tenants, a different way to alter production calendars to protect livestock is to synchronize calf births with one another. When births are staggered, a resident carnivore can predate a calf in one pasture, and then move to the next pasture when the next calf is born. If all of the calves, kids, lambs, etc. are born at the same time, it reduces the opportunity for carnivores to rotate between pastures (cited in Linnell et al. 1996)

Bolstering Alternative Prey

Piggybacking on this idea that carnivores optimize their foraging strategies, increasing non-livestock prey numbers may increase the chances that carnivores will predate native prey and can provide some protection to livestock. Research has shown that the number of cattle taken by mountain lions is inversely related to local prey abundance (Shaw 1977, Shaw 1981). Similarly, research suggests that coyotes eat livestock opportunistically, and in proportion to their availability relative to alternative prey (Sacks and Neale 2002). In addition, coyotes are better suited to eating small prey than they are to hunting cattle, equines, camelids, or large pigs. Bolstering native alternative prey abundance could help take predation pressure off of livestock of any species by increasing the likelihood that coyotes and mountain lions will select more abundant wild prey over livestock (Linnell et al. 1995, Linnell et al. 1996, Sacks and Neale 2002).

Attractant Removal

Although they are primarily hunters, coyotes, mountain lions, dogs, and bobcats are all opportunistic scavengers as well. Dead and downed animals may attract these carnivores into areas where other livestock are grazing and can increase depredation (cited in Linnell et al. 1996). Removing sick, injured, and dead livestock may help reduce attractants that are appealing

to carnivores, and may prevent further injuries to live animals. Some evidence suggests that carnivores are attracted to bone yards and may be more likely to kill livestock grazing in adjacent pastures, and bone yards may attract livestock guarding dogs away from the livestock protection duties (cited in Macon et al. 2017). The risk to suffering additional depredations is highest immediately following an initial depredation, as the carnivore returns to feed and may injure or kill additional animals.

When possible, it is best to isolate sick or injured animals and place them in a protected area or structure. For animals that have already died, it is best to bury or remove the carcass as soon as possible, as is stated in the current District policy, to discourage carnivores from returning to the site to feed. On open range, it may be difficult or impossible to locate and retrieve carcasses. In addition, extracting and transporting carcasses to a rendering facility may be resource intensive and expensive (Antonelli et al. 2016). In these cases, the best option may be to bury carcasses as far as possible from live animals or recreational trails, while making sure to follow local laws dictating burial depth, regulations on limiting potential disease transmission, ensuring the site is appropriately far from waterways, etc.

Carcasses may be treated with lithium chloride, cupric sulphate, anthelmintic thiabendazole, emetine hydrochloride, or alpha-naphthyl-thiourea to reduce palatability, however producers will need to seek CDFW permission before applying any of these chemicals (cited in Linnell et al. 1996). These chemicals are known to cause severe nausea and could be a useful tool in conditioning carnivores against preying upon cattle, however, results on taste aversion conditioning have been mixed. If the chemicals and dosages are carefully selected, this technique is thought to have limited negative effects on non-target species (Linnell et al. 1996). Many of these chemicals have been safely used on a wide variety of species (For example, emetine hydrochloride has been safely used with coyotes, raccoons, opossums, striped skunks (cited in Linnell et al. 1996); lithium chloride has been safely used with coyotes, domestic dogs, bears (Linnell et al. 1996), amphibians and reptiles (Paradis and Cabanac 2004), and avian scavengers (Nicolaus et al. 1989); etc.). It is possible that emetic chemicals could cause aversive behavior in scavengers. Whether or not chemical aversion is a successful tool, it is best to remove a carcass where possible, as the smell of rotting meat may attract carnivores and cause further depredations even if the meat is not palatable.

Current District regulations regarding animal remains are as follows:

701.7 Depositing of Animal Remains.

No person shall bury, leave, scatter or otherwise deposit animal remains on District lands, except for cremated animal remains as specified in Section 807.

807. Scattering of Cremated Remains

807.1 Regulations for the Scattering of Cremated Remains.

No person shall scatter any cremated human or animal remains (cremains) without first having obtained a written permit from the District, and shall abide by the permit conditions which shall include, but not be limited to, the following conditions:

a) The scattering of cremains is prohibited: within 1,000 feet of any residence or dwelling, within 500 feet of any creek, stream, or other body of water, or within 50 feet of any road or trail.
b) Cremains must be scattered, must not be left in a pile, and must not be readily visible to the public.
c) No containers for the cremains, identification tags, vases, flower pots, or other associated non-organic materials, or non-native plants, may be left at the site.
d) No memorial, plaque, or other site marker may be left at the site.
e) Any person scattering cremains on District lands shall possess and present a valid District permit when scattering cremains.
f) The scattering of cremains for commercial purposes is prohibited.

The current lease agreement language concerning disposal of livestock carcasses for District grazing tenants varies by location/lease. At McDonald, Driscoll, Bluebrush, and Lobitos-Elkus grazing areas the language is as follows:

> **(f)Disposal of Livestock Carcasses**. Tenant shall remove from the Premises, or bury on the Premises in a manner and location satisfactory to District, any and all livestock that may die on the Premises. Tenant shall immediately notify District upon discovering any dead livestock on or near the Premises. Tenant's notification shall state the proposed method and location for disposing of the dead livestock. The proposed method and location shall be subject to approval by District and may include permission to discharge firearms on the Premises in furtherance of the disposal.

The Mindego and Apple Orchard grazing areas have the following lease agreement language:

> **(d) Disposal of Livestock Carcasses**. Tenant shall remove from the Premises, or bury on the Premises in a manner and location satisfactory to District, any and all livestock that may die on the Premises. Tenant shall immediately notify District upon discovering any dead livestock on or near the Premises.

The October Farm, Tunitas, and Big Dipper leases contain this language:

> **(d) Disposal of Livestock Carcasses**. Tenant shall remove from the Premises, any livestock that may die on the Premises. Tenant is strictly forbidden to bury livestock carcasses on any District land. Tenant shall immediately notify District upon discovering any dead livestock on or near the Premises.

This language may need to be revisited and revised if carcass burial is determined to be an acceptable method for reducing predation.

E-Shepherd Collars

Designed for sheep, this tool is an electronic collar that monitors the animal's movement, recognizes when it is running, and triggers an ultrasonic alarm along with a set of LEDs with the goal of deterring the carnivore. The collar is only effective for the individual wearing it, unless

the animal wearing the collar responds to a fellow animal being harassed and is close enough to the incident for the collar to discourage the predator. Collars cost roughly $130 (plus shipping from South Africa), manufacturers recommend 1 unit for every 10 sheep, and batteries last from 16 to 19 months (replacement batteries cost roughly $16 plus shipping). These collars have been successfully used on cattle in India and Nambia (Delport, personal communication), however, since the collars are triggered by fleeing behavior, this may not be an effective tool for use with ambush predators, such as mountain lions. E-Shepherd Collar manufactures make no claims on efficacy against free-roaming dogs. There are no data on the efficacy of these collars on any type of livestock operation, as these collars have not been subject to rigorous scientific testing to date.

Cowbells

Producers may outfit livestock with bells to help locate animals, or to alert shepherds to when an animal is being chased, but there are little data established on whether this practice helps deter predation. Bells on sheep alone had no impact on coyote predation (cited in Linnell et al. 1996). There were no data on whether livestock guarding dogs and bells could used together to help alert dogs to an animal in distress. There were also no data on whether cowbells could allow livestock to keep closer track of one another and aggregate when threatened. If a range rider, a shepherd who stays with livestock to protect them against predation, is within earshot of the herd, a loud bell could allow them to intervene in the event that a carnivore is harassing an animal or the herd, but this would require a person to be on site at all times, making it a very resource-intensive tool. As a standalone tool, cowbells are unlikely to be helpful for District producers unless the livestock were being grazed near a ranch home or other site where people would be within earshot.

Human Presence

Intermittent human presence among widely dispersed livestock and low-density carnivores is unlikely to have a significant positive impact (Linnell et al. 1996). However, human presence, via herding, range riding, etc., can be highly effective in preventing depredations, as the shepherd can keep the herd together, monitor their safety, and intervene in the event of an intrusion. Unfortunately, this tool is incredibly labor and cost intensive, and likely infeasible without some form of subsidy.

Some carnivores, mountain lions in particular, are somewhat sensitive to human presence and will avoid hunting in areas with high human activity (Wilmers et al. 2013). However, other carnivores may recognize that human activities are often restricted to daylight hours and may instead shift their activities to after sunset (cited in Macon et al. 2017). Similar to visual and auditory deterrents, it is important to alter human activities so carnivores do not become habituated to certain routines and able to respond to times when they know the shepherd is absent. The key is to create an unpredictable landscape that carnivores prefer to avoid.

Since wolves were reintroduced in the mid 1990s, range rider programs have become a relatively common form of shepherding in the Northern Rockies. Some ranchers perceive range rider programs to reduce depredations, as well as a variety of social benefits (including reduced stress, reduced trespass and littering, improved public perception, and community trust building). Easier to verify benefits include identifying and treating sick animals, as well as finding and removing carcasses (Parks 2015). Many range rider programs rely on guest worker (H-2A) shepherds, most of whom come from South America. Changes in U.S. immigration policies may influence access to guest workers and could significantly affect the cost of range riding programs (American Sheep Industry Association 2015).

Volunteer Range Shepherd Program

In addition to range riders, or perhaps as an alternative, some projects have had success with volunteer range shepherds. The Wood River Wolf Project (WRWP) in Idaho designed a program in which volunteer shepherds helped protect bands of sheep against predation from black bears, grizzlies, mountain lions, coyotes, bobcats, and of greatest concern, wolves. Wolves were reintroduced to Idaho in 1995 and 1996, and as their population increased, so did conflict with livestock. The Wood River watershed is home to the "sheep superhighway," one of the largest grazing sectors in the state, and also experienced some of the highest sheep losses to wolves. A collaboration between conservation organizations, ranchers, scientists, federal government agencies, and county officials, the WRWP was started to implement and test predation deterrent strategies in an attempt to ameliorate the growing conflict between livestock producers and carnivores. Ultimately, the strategies the WRWP put in place reduced their depredation rate to 90 percent lower than neighboring sheep grazing operations (WRWP 2018). One of the strategies they utilized to achieve this remarkable success was a volunteer range shepherd program intended to deter carnivores by increasing human presence near livestock.

The WRWP worked with herders who managed bands of 1,000 to 2,000 sheep, and organized a fleet of volunteers to support the herders. These volunteer shepherds provided predation deterrence by increasing human presence near sheep bands, as well as contributing non-technical support to field staff and herders by shuttling supplies to the herders; assisting with injured animals (sheep, guard dogs, herding dogs or horses); installing, monitoring, and collecting game cameras in the field; collecting and entering data; driving personnel to and from the field; transmitting information between herders and field staff; and implementing other nonlethal deterrents. The volunteer range shepherds performed scheduled duties, and in the event that wolves were detected nearby, they were rapidly deployed to guard a specific band. It should be noted that a program that incorporates impromptu scheduling requires a much larger supply of volunteers than a program that strictly relies on preplanned activities (Martin personal communication, WRWP 2018).

There are a few notable features that would need to be addressed make a program like the WRWP suitable for implementation on District properties. First, most of the livestock productions on District land are low-density cattle operations, whereas the WRWP runs bands of

grouped sheep. A single person is much more effective monitoring and protecting a concentrated group of animals than it is for a group scattered across the landscape. Second, the local wolf packs in the Wood River watershed had one or more members collared, enabling a level of monitoring not possible for livestock producers on District land. Third, livestock in the WRWP were owned by 4 producers and protection efforts were coordinated by a single entity with staff dedicated to conflict prevention. In contrast, the District has a greater number of producers and does not currently have staff capacity earmarked for coordinating livestock protection efforts.

Aside from increasing human presence on the landscape and thereby reducing predation, range riders or range shepherds could also provide additional benefits to producers, as well as the general public. Previous range rider and range shepherd program users have reported appreciating extra help detecting injured animals and carcasses; maintaining and monitor camera traps, fencing, and other preventative tools (Foxlights, motion-activated sprinklers, etc.); detecting and reporting lost ear tags; collecting data on carnivore presence and habitat use patterns; etc. Potential benefits to the public would include increasing potential recreational activities on District land, including access to restricted areas, horseback riding, citizen science opportunities, etc. Even more importantly, this type of partnership between livestock producers and an increasingly urban general public would also provide a rare opportunity to teach Bay Area residents about the value of grazing and ranching, two frequently undervalued and often vilified practices.

When employing range riders or volunteer shepherds is impractical for producers, there are other strategies they can use to increase human presence. Feeding livestock each day could encourage herd aggregation and herding behavior, and human scent could act as a carnivore deterrent. In addition, frequent monitoring helps identify sick or injured individuals that could attract carnivores. Producers on District lands could use areas with high human recreational use as a potential shield against predation. Vulnerable livestock (such as cow-calf pairs when calves are young) could be give preferential access to highly frequented trails or camping areas to capitalize on increased human presence.

Hazing

When an animal is in an area that overlaps with vulnerable livestock, or is performing an unwanted behavior, a producer can deter the animal with unpleasant stimuli. Potential methods could include, but are not limited to, making loud noises in the carnivore's vicinity, chasing with trucks or hounds, throwing rocks, shooting with less-than-lethal munitions, etc. The target species and context will determine which tools are most appropriate. Hazing can be implemented as a general practice whenever a carnivore is seen in certain areas, or performing certain behaviors; or it can be used to target a particularly bold or aggressive individual. The most important components to hazing are to make sure the animal associates the negative stimulus with the undesired activity, and to follow through until the behavior has ceased. Though behavior-dependent, individually tailored hazing deterrents may be effective. Tools that

rely on a direct interaction between a carnivore and a human potentially put both parties at risk of injury and are very resource intensive. Any person conducting hazing activities should be specially trained and following strict protocols. It would be wise to consult legal counsel before implementing any hazing program. In addition, potential hazing strategies are nearly limitless, and CDFW policy surrounding hazing is relatively vague; it would be prudent to consult local CDFW personnel before selecting any questionable methods.

Coyotes

When hazing coyotes, the person conducting the hazing activity should be sure to stand their ground; make eye contact to make sure the coyote is focused on them as the source of the disturbance. Hazing tools should be exaggerated, assertive, and when possible, should capitalize on as many senses as possible by using tools that involve sound, light, and motion. It is helpful to have variety in tools as well as the individuals administering the hazing. Coyotes can learn to recognize and avoid individual people, so varying both the tools and people involved or the clothing of the people involved (i.e. perform the hazing activity in street clothes rather than a uniform) will help avoid habituation and can decrease the number of hazing bouts necessary to teach the coyote to avoid the area more quickly.

If the coyote hesitates (freezes or moves away only a short distance), the person involved should intensify their efforts and advance toward it with the hazing tools (yelling, noisemaker, throwing rocks, waving arms, water gun, etc.). Always be sure to haze the animal until it has fully retreated to send a clear message that they should associate humans with discomfort.

It is critical to provide an escape path for the animal (i.e. never corner a coyote). It is most effective to haze on foot rather than from a building or a car where the coyote may not be able to see the person; the goal is to have the animal associate humans with danger, so it is best if they can clearly draw a link between the two. To ensure that coyotes do not return to displaying unacceptable behavior over time, it is helpful to maintain a practice of hazing in even casual interactions. Hazing should not take place if the coyote looks sick or injured, or if it has pups. In those cases, the best thing to do is to maintain eye contact and back away.

Mountain Lions

Mountain lions are very cryptic and secretive, making their behavior difficult to observe in a natural setting. As such, there is very little data on hazing practices and their efficacy; most of the information available comes from anecdotal reports. Washington Department of Fish and Wildlife uses Karelian bear dogs to haze bears, and on occasion, mountain lions, that have wandered into residential areas. They have been effective at reducing recidivism in bears, but there is insufficient data to determine whether this is an effective tool for mountain lions (Beausolei, personal communication). A study in Brazil found that targeted firecrackers and night patrolling were effective hazing tools for preventing jaguar and mountain lion depredations (Cavalcanti et al. 2012).

Increase Human Tolerance for Carnivores

Whether it is delivered when an animal is harvested, or prematurely from an unintended source, death will always be a certainty in livestock production. Perhaps more so than other sources, depredations are both an emotional and financial issue. Though it is difficult as an agency to tackle the emotional side of depredations, there are tools that can be used to lessen the financial burden. By removing some of the financial cost to operating livestock in carnivore country, perhaps the District can increase tolerance for carnivores and predation on livestock.

One option for improving producer experience with carnivores is to create or support labeling programs that allow producers access to markets where consumers are willing to pay a premium on products utilizing practices that support consumer values (in this case, carnivore friendly ranching). This has been very successful for promoting and mainstreaming practices such as organic, grass-fed, etc. For producers selling their beef locally, the Bay Area is likely a prime market for selling wildlife-friendly meat.

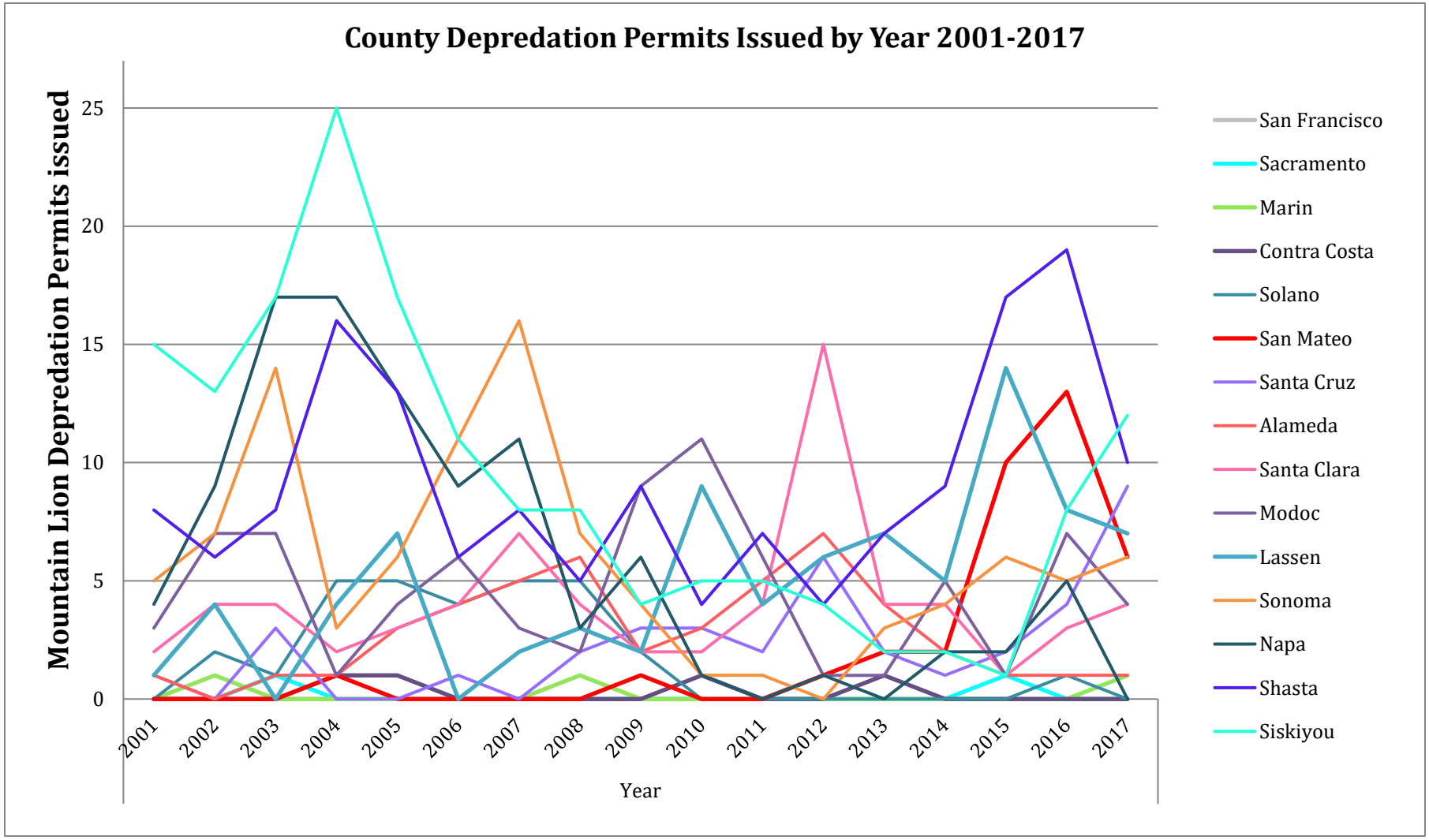
There are currently a few groups that certify and/or promote wildlife-friendly and/or carnivore friendly livestock management practices. For example, Wildlife Friendly Enterprise Network certifies a variety of livestock operation types and other agricultural producers from across the country who commit to a strict set of criteria to qualify for "Predator Friendly" status. Started in 1991, the program requires that participating producers employ only non-lethal preventative livestock predation deterrents. Each operation is audited and monitored annually to ensure that preventative practices remain in place. In turn, Wildlife Friendly Enterprise Network provides various marketing incentives for producers to join the program. Though this does not prevent conflict, it uses the market to help defray the cost of coexisting with carnivores and makes that relationship more profitable for producers. If producers operating on District lands can pass the cost of ranching alongside carnivores on to consumers willing to pay a premium on local products in which they believe, perhaps carnivores will become less of a burden to producers.

An alternative option for decreasing the cost of ranching alongside carnivores is to provide producers with reduced grazing fees. As mentioned above, this is a tool used at Point Reyes National Seashore, where livestock producers are indirectly compensated for costs associated with carnivores with a reduced grazing fee of $7.00 per AUM. The District currently charges a reduced fee of $16.15 per AUM in part to help defray costs associated with raising livestock in rugged carnivore habitat. Producers that run cattle on federal land under the Bureau of Land Management and Forest Service were charged a grazing fee of $1.87 per AUM for 2017 (BLM 2018). In contrast, this year the East Bay Regional Park District is charging $20.75 per AUM (EBRPD 2018, Defreese, personal communication); East Bay Municipal Utilities District is charging $26.40 per AUM (Swann, personal communication), and SFPUC is charging $19.90 per AUM (Dakin, personal communication).

Communicate Dog Restrictions to the Public

Though District tenants do not report dogs as their main concern, there are a few things that the District could to do keep dog issues to a minimum. It could be beneficial to communicate the logic behind the District's leash policies. On the District's website addressing dog rules and regulations (https://www.openspace.org/what-to-do/activities/dogs), there is no mention of being vigilant around cattle, and especially calves. The District is home to a vast network of trails, and much of the adherence to following park rules is done so voluntarily. It could build support and leash rule compliance to create online materials and/or signage that let dog owners appreciate their roles as rangeland stewards. Additionally, alerting the public to their level of potential liability should their dog injure livestock (see Legal Status and Regulations - Dogs above) could help prevent negative interactions.

Appendix


County Depredation Permits Issued by Year 2001-2017
Mountain Lion Depredation Permits issued
25
20
15
10
5
0
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
Year
San Francisco
Sacramento
Marin
Contra Costa
Solano
San Mateo
Santa Cruz
Alameda
Santa Clara
Modoc
Lassen
Sonoma
Napa
Shasta
Siskiyou

Appendix 1: Reported depredation permits issued to each of the Bay Area counties and the counties in which wolves have had a significant presence. Overall, San Mateo County has lower reported depredation permits than neighboring counties, however, there has been an increase in the last 4 years (Data are available from CDFW 2018).

County	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Alameda	1	0	1	1	3	4	5	6	2	3	5	7	4	2	1	1	1
Alpine	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Amador	15	13	8	7	5	3	7	8	6	3	5	3	4	16	4	5	3
Butte	0	3	3	5	6	1	3	0	5	5	5	1	3	7	8	6	10
Calaveras	7	10	13	22	19	9	13	6	7	16	9	6	14	30	13	10	6
Colusa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Contra Costa	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0
Del Norte	0	0	0	4	1	3	0	1	0	2	1	0	0	1	1	0	2
El Dorado	22	14	19	19	5	7	4	4	4	17	13	16	16	23	29	13	15
Fresno	3	4	1	2	1	1	2	4	0	2	1	2	2	4	7	2	2
Glenn	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Humboldt	6	4	8	12	9	11	10	5	8	8	6	6	3	3	8	0	10
Imperial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inyo	0	2	0	2	1	0	0	0	0	0	3	1	0	0	0	1	0
Kern	3	4	2	1	4	4	3	0	4	1	1	2	3	1	8	7	1
Kings	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lake	1	2	3	1	5	1	2	3	1	1	1	0	4	1	1	3	1
Lassen	1	4	0	4	7	0	2	3	2	9	4	6	7	5	14	8	7
Los Angeles	1	1	1	1	1	0	2	1	0	0	0	1	0	5	1	1	0
Madera	0	3	1	1	0	2	1	0	3	4	1	3	2	3	11	5	4
Marin	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Mariposa	2	3	0	2	5	3	10	2	3	2	7	8	5	12	11	8	11
Mendocino	26	35	20	31	18	10	17	9	5	6	13	7	5	4	7	21	13
Merced	0	0	0	0	0	0	1	0	0	1	0	1	1	0	0	1	0
Modoc	3	7	7	1	4	6	3	2	9	11	6	1	1	5	1	7	4
Mono	1	0	0	0	1	1	0	1	0	1	0	2	0	0	1	0	0
Monterey	2	8	5	7	6	2	13	2	5	0	3	3	5	7	4	8	2

Napa	4	9	17	17	13	9	11	3	6	1	0	1	0	2	2	5	0
Nevada	2	6	5	12	4	7	6	1	2	2	5	3	5	4	7	14	10
Orange	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Placer	7	5	3	2	0	4	1	0	1	4	2	4	1	4	7	5	4
Plumas	8	7	4	3	8	4	4	2	0	0	1	10	3	4	2	4	4
County	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Riverside	4	6	2	9	2	4	1	0	4	0	0	1	7	4	1	0	0
Sacramento	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
San Benito	1	0	0	0	0	0	1	0	0	0	4	0	0	0	0	0	0
San Bernardino	1	3	1	1	0	2	4	0	0	2	0	0	3	1	0	1	1
San Diego	7	4	1	0	0	1	1	0	0	0	2	2	2	5	2	6	2
San Francisco	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Joaquin	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Luis Obispo	3	5	7	16	8	9	6	6	2	1	7	3	10	11	24	6	7
San Mateo	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**1**	**2**	**2**	**10**	**13**	**6**
Santa Barbara	1	2	0	1	7	2	7	3	3	2	0	0	3	3	4	6	1
Santa Clara	2	4	4	2	3	4	7	4	2	2	4	15	4	4	1	3	4
Santa Cruz	1	0	3	0	0	1	0	2	3	3	2	6	2	1	2	4	9
Shasta	8	6	8	16	13	6	8	5	9	4	7	4	7	9	17	19	10
Sierra	2	1	1	0	0	0	2	1	1	0	1	0	0	1	0	0	1
Siskiyou	15	13	17	25	17	11	8	8	4	5	5	4	2	2	1	8	12
Solano	0	2	1	5	5	4	5	5	2	0	0	0	0	0	0	1	0
Sonoma	5	7	14	3	6	11	16	7	4	1	1	0	3	4	6	5	6
Stanislaus	1	0	0	1	1	2	2	4	2	0	0	0	1	2	0	0	0
Sutter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tehama	1	1	0	3	2	1	1	0	1	4	0	0	2	1	4	4	1
Trinity	9	8	9	8	10	11	10	9	11	5	4	4	2	2	4	0	2
Tulare	1	1	1	3	2	2	0	0	0	0	0	0	0	0	0	2	0
Tuolumne	10	8	12	5	5	3	10	23	10	5	2	1	14	18	20	12	11
Ventura	0	0	1	2	1	4	3	0	1	0	0	0	1	1	1	1	0

Yolo	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Yuba	0	0	4	1	1	0	0	3	0	0	0	0	1	0	2	6	2

Appendix 2: Reported depredation permits issued for all counties in California from 2001 through 2017. It is important to note that not all depredations are reported; these data may not reflect every depredation incident that occurred within that county for a given year. It should also be noted that not all of the permits issued resulted in mountain lions being removed (These data were used to make the graph in Appendix 1 and are available from CDFW 2018).

Operation Timing	Acreage	Percent Grazed Acreage	AUM	Percent AUM	Operation Type	
					Stockers	Cow/Calf Pairs
Seasonal	2,096	19	1,096	23	1	3
Year-round	8,717	81	3,640	77	2	6

Appendix 3: Year-round and seasonal grazing on District properties. There are 10 properties that have cattle grazing, 4 of which are seasonal (representing 19 percent of grazed land), and the remaining 6 are year-round (representing 81 percent of grazed land). Both the type of operation and operation timing can influence predation risk. For example, whether an operation is running stockers versus cow/calf pairs (with higher predation risk for cow/calf pairs) or whether an operation is seasonal versus year-round (with higher predation risk for year-round operations). Factors may also interact, elevating or decreasing risk accordingly. For example, holding all other factors constant, the rank order of highest potential relative risk to least would be the following:

Year-round cow/calf pairs > seasonal cow/calf pairs > year-round stockers > seasonal stockers

Tool	Coyote	Mountain Lion	Bobcat	Dog
Targeted lethal removal	Results Vary	No Data	No Data	No Data
Permanent wire fencing	Moderately Effective	Not Effective	Not Effective	Effective
Permanent electric fencing	Effective	Moderately Effective	Effective	Effective
Temporary electric fencing	Effective	Results Vary	Effective	Effective
Fladry / Turbo fladry	Results Vary	No Data	No Data	No Data
Night penning	Effective	Effective	Effective	No Data+
Livestock guarding dogs	Effective	Effective	Effective	Effective
Llamas	Moderately Effective	Not Effective	No Data+	Effective
Donkeys	Effective	Moderately Effective	No Data+	Effective
Frightening deterrents	Moderately Effective	Moderately Effective ~	No Data+	No Data
Changing cattle breed	No Data+	No Data+	No Data+	No Data+
Altering pasture vegetation	No Data+	No Data+	No Data+	No Data
Altering production calendar	Moderately Effective	Moderately Effective	Moderately Effective	No Data*
Bolstering alternative prey	Moderately Effective	Moderately Effective	No Data+	No Data
Attractant removal	Effective	Effective	Effective	No Data+
E-shepherd collar	No Data+	No Data*	No Data	No Data+
Cowbell	No Data*	No Data*	No Data*	No Data*
Human presence	Results Vary	No Data+	No Data+	No Data
Hazing	Effective	No Data	No Data	No Data

Appendix 4: Livestock protection toolkit. The practicality and efficacy of any particular tool will depend on the type and scale of the operation, livestock species, duration of use, etc. In addition, each tool may have very specific implementation instructions, and deviation from those guidelines may render the tool ineffective.

+ Likely moderately effective to effective

* Likely ineffective

Appendix 5: Acronyms and Abbreviations

AUM	Animal Unit Month
BLM	Bureau of Land Management
CDFW	California Department of Fish and Wildlife (2013- present)
CDFG	California Department of Fish and Game (1909-2012)
CCR	California Code of Regulations
District	Midpeninsula Regional Open Space District
DNA	Deoxyribonucleic acid
EBMUD	East Bay Municipal Utilities District
FGC	Fish and Game Code
GPS	Global Positioning System
LGA	Livestock Guarding Animal
LED	Light emitting diode
LGD	Livestock Guarding Dog or Livestock Guardian Dog
MCP	Marin County Program
MVZ	Museum of Vertebrate Zoology
NPS	National Park Service
SFPUC	San Francisco Public Utilities Commission
UCANR	University of California Agriculture and Natural Resources
UCCE	University of California Cooperative Extension
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
WS	Wildlife Services
WRWP	Wood River Wolf Project

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RANCHO MISSION VIEJO

March 30, 2020

VIA EMAIL

California Fish and Game Commission
1416 Ninth Street, Room 1320
Sacramento, CA 95814

Reference: Agenda Item 32: Mountain Lion CESA Petition

Subject: Rancho Mission Viejo Comments

Dear Members of the California Fish and Game Commission:

Rancho Mission Viejo (RMV) provides the following comments for your consideration as you determine whether listing under the California Endangered Species Act (CESA) is warranted for the mountain lion as recommended in the Petition to List One or More Evolutionary Significant Units of Mountain Lion in Southern and Central Coastal California as Threatened or Endangered under the CESA ("Petition").

Rancho Mission Viejo (RMV) is located in Southern Orange County and is owned and managed by the O'Neill family. The ranch is bound by the existing communities of Rancho Santa Margarita, Mission Viejo, San Juan Capistrano and the undeveloped Cleveland National Forest and MCB Camp Pendleton. Various habitat types including but not limited to coastal sage scrub, chaparral, grassland, oak woodland and riparian are present on the ranch. Since 1882, the O'Neill family has been a responsible steward of the Ranch. We have, and continue to actively manage the Ranch to protect the resources on it. We intend to continue this tradition of stewardship into the future through implementation of the Southern Subregion Habitat Conservation Plan (SSHCP), approved by U.S. Fish and Wildlife Service on January 10, 2007.

RMV is the principal permittee under the SSHCP. In summary, the SSHCP Conservation Strategy provides a comprehensive, habitat-based approach to the protection of covered species and their habitats by focusing on the lands and aquatic resource areas essential for the long-term conservation of the covered species and by providing for appropriate management for those

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lands. The SSHCP Habitat Reserve ultimately will conserve approximately 32,818 acres in southern Orange County, comprised of historic Rancho Mission Viejo lands and three County of Orange wilderness parks.

We wish to inform the Commission of how the SSHCP Habitat Reserve, a product of existing regulatory mechanisms and management efforts, benefits the mountain lion, and in particular the Santa Ana Mountain (SAM) population. Establishment and management of the SSHCP Habitat Reserve address several of the management and recovery recommendations contained in the Petition, including: 1) Habitat Protection, 2) Crossing Infrastructure, 3) Rodenticides and Pesticides, and 4) Other Protective Measures and Management.

Habitat Protection

The Petition recommends full protection of mountain lion habitat, including resource-use patches and movement corridors, and a prohibition on large-scale development in primary travel corridors and habitat linkages, including between the SAM and Eastern Peninsula Range (EPR).

The mountain lion was addressed as a "planning species" in preparation of the SSHCP even though it was not a federally listed species or otherwise protected by federal regulations (Draft NCCP/HCP Planning Guidelines 2004, or "Planning Guidelines"). It is not a "Covered Species" in the SSHCP. Because the SSHCP was originally planned as a joint NCCP/HCP, the Planning Guidelines incorporated the "NCCP Tenets" outlined in the NCCP Conservation Guidelines and "Reserve Design Principles" based on the NCCP Tenets prepared by a panel of NCCP Science Advisors convened by The Nature Conservancy. The Planning Guidelines were

> *intended to provide an objective and common set of planning considerations and recommendations for use by resource and regulatory agencies and program participants in selecting and evaluating reserve program, restoration and management alternatives for the Southern Subregion NCCP/HCP.*
>
> (p. 1-1)

With respect to the mountain lion, and consistent with the information presented in the Petition, this species ranges throughout much of undeveloped portions of the SSHCP planning area. A radiotracking study found that virtually the entire planning area is habitat for the SAM population (Barrett and Beier 1993) (see attached Figure 169-M). Identified important use areas in this study include Arroyo Trabuco, Thomas Riley Wilderness Park, and the Richard & Donna O'Neill Conservancy. Surveys in the early 1990s for the proposed Foothill Transportation Corridor (SR-241), which was proposed to run north-south through the central portion of the planning area, recorded mountain lions at three camera stations, including within Cristianitos Canyon and Blind and Gabino canyons within the San Mateo Watershed and Sulphur Canyon

within the San Juan Creek Watershed. Other identified important "live-in"[1] and movement habitat in the planning area that connects to larger core habitat in the Cleveland National Forest includes La Paz and Blind canyons in the San Mateo Watershed and Verdugo Canyon in the San Juan Creek Watershed. The western portion of the planning area, including Arroyo Trabuco, Sulphur Canyon (associated with Chiquadora Ridge) and Chiquita Ridge in the San Juan Creek Watershed, was considered less suitable as live-in habitat for mountain lions when planning for the SSHCP was initiated in 1993 due to existing urbanization and agricultural land uses, resulting in smaller core habitat patches, but these areas still provide important movement habitat.

The Planning Guidelines included two main Planning Recommendations for mountain lion - Protection Recommendations and Management Recommendations:

1. Protection Recommendations

- *Protect "live-in" habitat within the portion of the San Mateo Watershed in the planning area and Verdugo Canyon in the San Juan Creek Watershed adequate to meet the life history requirements of the mountain lion, comprising a large, unfragmented block of chaparral and coastal sage scrub directly connected to more than 100,000 acres in Caspers Wilderness Park, the Cleveland National Forest, and Camp Pendleton. (Beier and Barrett [1993] describe the Santa Ana Mountain Range as encompassing 800 mi^2 [512,000 acres) of "contiguous wildlands used by cougars." This habitat includes the Santa Margarita Mountains, the Santa Rosa Plateau, the Chino Hills and the San Joaquin Hills.) "Live-in" habitat provides adequate prey (primarily mule deer) and vertical and horizontal cover suitable as resting and bedding sites (e.g., woodlands and riparian areas, rocky areas). The reader should note that the "live-in" habitat within in* [sic] *the San Mateo Watershed portion of the planning area and Verdugo Canyon would only provide about 25-30 percent of an average mountain lion home range in the Santa Ana Mountains (Padley 1989, 1996), and that the home range of any lions using the planning area likely will include Caspers Wilderness Park, Audubon Starr Ranch Sanctuary, Cleveland National Forest, and Camp Pendleton.*

- *Maintain habitat connections throughout the planning area to provide movement opportunities for the mountain lion. As described above for individual sub-basins, as well as other areas in the planning area, important movement areas for mountain lion include Arroyo Trabuco, the Foothill-Trabuco Specific Plan Area, Chiquita Ridge, Sulphur Canyon, San Juan Creek, Trampas Canyon, Cristianitos Canyon, Verdugo Canyon, Gabino Canyon, La Paz Canyon and Talega Canyon.*

[1]Live-in habitat is includes large, unfragmented areas that provide for most if not all of the mountain lion's life history requirements including food, shelter, denning sites, and food sources (primarily mule deer).

2. Management Recommendations

In areas identified as "live-in" habitat or habitat connections, roads that are necessary to serve approved land and water uses located inside or outside the Habitat Reserve shall be designed and sited to accommodate mountain lion movement to the maximum extent feasible. Where roads are necessary, under the approved NCCP/HCP, they will be designed consistent with safety, roadway design criteria that are appropriate for the setting and desired roadway function. Roadway design shall include bridges and/or culverts large enough to accommodate mountain lion movement at key areas and, where appropriate and feasible, may include wildlife over crossings. As appropriate, fencing, grading and plant cover will be provided to serve wildlife crossings consistent with conservation principles and the adaptive management program. Where feasible and safe, lighting along roadways within the Habitat Reserve should be avoided. Where roadway lighting within the Habitat Reserve is necessary for public safety reasons, it should be low-sodium or similar low intensity lighting that is directed away or shielded from the Habitat Reserve.

These Protection and Management Recommendations for mountain lion were incorporated into the SSHCP in Appendix E.

Upon completed phased dedication of open space timed in relation to development, the SSHCP Habitat Reserve ultimately will conserve approximately 32,818 acres, representing about 72 percent of the vegetation communities and other landcovers in Subarea 1[2], as well as an additional 4,400 acres of Supplemental Open Space (SOS)[3], resulting in the protection of at least 81 percent of the vegetation communities/landcovers in Subarea 1. Approximately 16,536 acres of the planned Habitat Reserve are located on RMV-owned lands.[4] The SSHCP concluded that this level of protection would be adequate to support the wildlife planning species addressed in the Planning Guidelines, including mountain lion and its main prey mule deer (see SSHCP Chapter 13, pp. 199- 226-227). The Petition states that the SAM mountain lion population inhabits about 1,533 km^2 (~379,000 acres) of undeveloped areas, so the Habitat Reserve and SOS comprise just under 10% of the total inhabited area in the SAM range. As noted above, habitat within in the San Mateo Watershed portion of the planning area and Verdugo Canyon in the San Juan Creek Watershed would provide about 25-30 percent of an average mountain lion home range in the SAM range and that the home range of any lions using the Habitat Reserve likely

[2] The Southern Subregion NCCP/HCP planning area is divided into four Subareas. Subarea 1 includes the RMV General Plan Amendment/Zone Change ownership, previously set aside open space owned by RMV, the County-owned parklands and Prima Deshecha landfill, the National Audubon Society Starr Ranch and portions of the Santa Margarita Water District lands.

[3] Supplemental Open Space (SOS) refers to designated open space that although not a part of the managed Habitat Reserve, serves to contribute to the subregional Conservation Strategy by providing additional open space containing a combination of vegetation communities supporting Covered Species, wildlife connectivity and refugia areas within the study area which enhance the overall function and value of the Habitat Reserve.

[4] Changes to the Habitat Reserve boundaries that have occurred since approval of the HCP have increased the size of the Habitat Reserve to 33,306 acres.

will include Caspers Wilderness Park, Audubon Starr Ranch Sanctuary, Cleveland National Forest, and/or Camp Pendleton as these areas comprise a large, mostly unfragmented habitat area.

Further, 89 percent of the Habitat Reserve/SOS occurs in three large, contiguous and functionally connected Habitat Blocks analyzed in the context of the NCCP Conservation Guidelines Reserve Design Tenets and the Reserve Design Principals, based on the NCCP Tenets, prepared by the NCCP Science Advisors. These Tenets and Reserve Design Principals consider the conservation of planning species (including mountain lion); habitat block size; habitat contiguity (i.e., lack of fragmentation) and connectivity; and biological diversity and physiographic representativeness (e.g., spatial distribution and elevation).

As shown in attached Figure 159-M, the Eastern Block is a large, contiguous habitat block containing approximately 23,210 acres. It includes the San Mateo Watershed within RMV lands south of Verdugo Canyon and the San Juan Creek Watershed north of Verdugo within Caspers Wilderness Park, Starr Ranch Sanctuary, and Cleveland National Forest. The Eastern Block provides core live-in habitat and several movement corridors for mountain lions, including along San Juan Creek, Bell Canon, Verdugo Canyon, Gabino Canyon, La Paz Canyon, Cristianitos Canyon, and Talega Canyon (see attached Figures 159-M and 169-M).

The Western Block is a smaller 7,300-acre block to the west, extending from the Upper Chiquita Canyon Conservation Area in the northern portion of Chiquita Canyon to San Juan Creek and connecting with adjacent portions of Chiquadora Ridge, the Riley Wilderness Park, Gobernadora Creek, and to Caspers Wilderness Park via an open space corridor (linkage I) at the northern edge of the PA 3 development area. This Western Block is less suitable as live-in habitat for mountain lion due to adjacent existing and planned/under construction development (PA 3) and agricultural land uses, resulting in smaller unfragmented habitat patches, but this block still provides movement habitat through the Habitat Reserve for the species.

The Arroyo Trabuco Block is a 1,900-acre block of habitat in Arroyo Trabuco that extends north-south from the Cleveland National Forest to San Juan Capistrano. Most of Arroyo Trabuco has been constrained by adjacent urban development for decades, but still provides movement habitat for mountain lions.

The three habitat blocks are all interconnected by habitat linkages that will be preserved and managed in the Habitat Reserve by RMV or the County of Orange, as shown in Figure 159-M. The Arroyo Trabuco and Western habitat blocks are connected by existing linkage B between the existing Ladera Ranch and Las Flores developments, which has a minimum width of about 1,500 feet. The Western and Eastern blocks are connected by linkages I and J. Linkage I is located between existing Coto de Caza and planned PA 3 and would have a minimum width of 2,000 feet. Linkage J is located along San Juan Creek and would have a minimum width of about 1,320

feet with planned setbacks from the 100-year floodplain. Basically all the labeled linkages except F, K, R and S, which are either constrained by size, or do not connect to suitable mountain lion habitat under the SSHCP, may be used by mountain lions for movement through the Habitat Reserve. However, since the SSHCP was approved in 2007, additional open space has been planned for linkage K related to development of PA 5. Under the SSHCP, linkage K would have had narrow dimensions (just a few hundred feet wide at some points) had PA 5 development occurred all the way to its southern boundary as proposed under the adopted B-12 Alternative (Figure 155-M). With the proposed additional open space, linkage K would be more than 1,200 feet wide at its narrowest point if one includes the natural open space along the northern border of the Talega development south of the RMV property boundary, thus expanding habitat for east-west habitat connectivity via linkage K that could be used by mountain lions.

Further, the SSHCP Habitat Reserve Management Program (HRMP) requires monitoring and management of certain vegetation communities in habitat linkages and wildlife corridors in the Habitat Reserve, including oak woodlands, riparian/wetland, coastal sage scrub and chaparral. Periodic 5-year Management Action Plans (MAPs) include goals and objectives for each community to ensure their functionality for wildlife use and movement, including mountain lions. For example, the most recent 2019-2024 MAP includes *Objective OW1.3. Maintain acreage of oak woodland communities in the identified habitat linkages and corridors in 2023 within 5% of 2008 baseline values.* Along with each explicit objective, the MAP spells out a Monitoring Approach (e.g., periodic mapping), a Management Action Threshold (e.g., a threshold percent change below baseline levels), and possible Management Actions (e.g., health assessments and remedial restorative actions).

Crossing Infrastructure

The Petition recommends designing and building wildlife crossings in strategic locations to improve wildlife connectivity, including overcrossings, underpasses, culverts, and exclusionary fencing to guide wildlife to safer crossings. Recommendations of mountain lion experts include crossings of Interstate 15 (I-15) approximately 20 miles east of the Habitat Reserve connecting the SAM to the EPR. The Petition also recommends that suitable habitat exists, through preservation or restoration/enhancement, on both sides of crossing structures, and that human activity be restricted and foot trails located away from the structures.

As described above, the three large habitat blocks - Arroyo Trabuco, Western, and Eastern - have high habitat contiguity and provide suitable habitat for mountain lion movement throughout the Habitat Reserve. As analyzed in the SSHCP, however, the construction of roads and other infrastructure within the Habitat Reserve, would contribute to some additional internal fragmentation in the future that could affect mountain lion movement. PAs 1 and 2 have been mostly fully developed, and construction in PA 3 began in January 2020.

Attached Figure 155-M shows the proposed circulation system analyzed in the SSHCP. Cow Camp Road, running east-west between San Juan Creek and PA 2 and through PA 3, was proposed to cross Chiquita Creek (linkage C), Gobernadora Creek (linkage G) and San Juan Creek (linkage J) with bridges. Per the SSHCP, each of these crossings would be designed to maximize the likelihood of long-term connectivity and contiguity. For example, per the SSHCP, bridge heights would be a minimum of 20 feet high to minimize shading effects on riparian vegetation. To date, the Cow Camp Road bridge over Chiquita Creek has been constructed and the roadway was moved north to within the PA 2 development to minimize direct impacts to the Habitat Reserve. This bridge spans more than 1,400 feet across the confluence of Chiquita and San Juan creeks and is 50-60 feet high, well in excess of the minimum 20-foot requirement in SSHCP. The bridge crossings of Gobernadora and San Juan Creeks are associated with development of PA 3. The Cow Camp Bridge over Gobernadora Creek is under construction and will be complete later this year. This bridge spans 1,360 feet across Gobernadora Creek and is also 50-60 feet high, also well in excess of the minimum 20-foot requirement in the SSHCP. Grandeza Bridge over Gobernadora Creek from PA 2 to PA 3 will fully span Gobernadora Creek (and most of the canyon) at a height of approximately 130 feet, well in excess of the minimum 20-foot requirement in the SSHCP. Cow Camp Road Bridge over San Juan Creek will be designed to at least exceed the 20-foot requirement in the SSHCP.

Most significantly the northern portion of Los Patrones Parkway (referred to as "F Street" in the SSHCP) has been constructed south to PA 2 along the eastern side of Chiquita Canyon from its connection with SR-241 at Oso Parkway in the north. It generally follows the alignment previously proposed for SR-241, as shown in attached Figure 155-M. Attached Figure 159-M shows two conceptual east-west movement linkages across Chiquita Canyon north of PA 2. To facilitate wildlife crossings of Los Patrones Parkway, two large wildlife undercrossings were constructed to convey wildlife between Chiquita Canyon and Sulphur Canyon, which is a documented mountain lion movement corridor that links Chiquita Canyon in the west to Caspers Wilderness Park to the east via linkages H and I. In addition, all drainage culverts were upsized to 60 inches to accommodate mountain lion and other smaller predator movements. Camera studies have documented at least one mountain lion entering one of the undercrossings, as well as numerous mule deer. These studies are part of a Wildlife Corridor Monitoring Report required by CDFW for five years following the roadway opening. In addition, wildlife exclusion fencing was installed along portions of Las Patrones Parkway based on recommendations by mountain lion expert Dr. Winston Vickers, who conducted recent studies in the region.

Rodenticides and Pesticides

The Petition reviewed the available information on pesticide and herbicide effects on mountain lions (pp. 50-51). The Petition cites evidence from several studies for secondary poisoning of predators such as coyotes, bobcats, kit foxes, fishers, and raptors which could be extrapolated to

similar effects on mountain lions. Evidence of secondary poisoning of mountain lions is more limited, but researchers have found high rates of rodenticides in the systems of mountain lions and suspect that these rodenticides could be associated with direct deaths and with weakened immune systems that may make them more vulnerable to risk factors such as intraspecific conflicts. With respect to legal herbicides such as glyphosate, the Petition does not cite specific data for direct or secondary poisoning, but infers that mountain lions could be detrimentally exposed to herbicides through deer, which may browse on contaminated plants. This may be a particular problem in agricultural areas where crops browsed by deer may be subject to broad-scale herbicide treatment. As such, the Petition recommends prohibiting the use of second-generation anticoagulant rodenticides ("SGARs"), such as brodifacoum, bromadiolone, difenacoum, and difethialone in core habitat areas and linkages, and limiting the use of other pesticides and herbicides that may have negative effects.

Appendix J, Invasive Species Control Plan ("Control Plan"), to the SSHCP describes the control and eradication methods to be used in the Habitat Reserve to control invasive plants and introduced predators on sensitive species. Invasive species can have large-scale detrimental effects on natural vegetation communities and wildlife, and thus are an important focus of the HRMP. Control methods included mechanical (e.g., hand pulling, dragging, digging, etc.) and targeted use of chemical herbicides and pesticides. Acceptable uses of pesticides and herbicides are prescribed in the Control Plan, including a consideration of the potential adverse collateral effects on non-target species. The recommended methods for controlling particular plant species in the Control Plan were cross-referenced with the California Interagency Noxious Weed Coordinating Committee and Invasive Plants of California Wildlands' CalWeed Database. Overall, long-term control of invasive plants and introduced predators on RMV and throughout the Habitat Reserve will enhance habitat functions for native plant and animal species, which use and occupy the Habitat Reserve, and will substantially increase the likelihood that the Habitat Reserve will function successfully and provide for persistence and recovery of target species.

Rodenticides, which appear to have significant adverse effects on mountain lions, are not allowed in the Habitat Reserve. Chemical controls in the Habitat Reserve are currently restricted to targeted use of herbicides for pernicious invasive species such as giant reed (*Arundo donax*) which primarily occurs in creeks and artichoke thistle (*Cynara cardunculus*) which occurs in uplands, and chemical controls on the non-native invasive Argentine ant (*Linepithema humile*) and red imported fire ant (*Solenopsis invicta*). As other non-native plant species invasions of the Habitat Reserve occur, targeted herbicidal controls may be applied as needed and appropriate if mechanical removal is not effective, practical, or feasible. Per the SSHCP, use of pesticides in areas adjacent to the Habitat Reserve (e.g., golf courses) will be minimized to the extent feasible and will be used in accordance with an Integrated Pest Management Program designed to avoid and minimize effects on native species and habitats.

An example is San Juan Creek (linkage J) where large-scale giant reed removal has occurred over the past several years and was completed 2018. It is expected that the giant reed control program will be in a maintenance phase in the future where smaller, localized infestations are detected through regular monitoring and treated as-needed. As part of its cattle ranching operations, RMV has consistently performed eradication of artichoke thistle across most of the RMV property since the 1970s and efforts continue as-needed. Artichoke thistle still occurs in certain areas of the Habitat Reserve, but in much smaller populations compared to other un-managed coastal uplands due to the consistent ongoing control efforts.

According to the Invasive Species Control Plan, chemical controls of Argentine ants and fire ants are planned to occur on an as-needed, targeted basis when major outbreaks occur. Emerging methods that avoid and minimize potential impacts to non-target species will be employed to the extent feasible, such as bait traps designed to preclude access by non-target species. Controls on Argentine ant will be conducted as part of the Habitat Reserve management program, primarily along the urban-Habitat Reserve interface where mountain lion activity is less likely. Controls of fire ants is conducted by Orange County Vector Control on an as-needed basis, primarily along Chiquita Creek to date, which is not considered live-in habitat for mountain lions, but which may support movement.

As noted above, rodenticides are not used in the Habitat Reserve as a management tool and thus management actions are not expected to contribute to such impacts in the SAM population. Adverse effects of herbicides, mediated through deer could possibly occur, but are expected to occur at low levels, if at all. Herbivory of artichoke thistle by deer is unlikely because of the plant's spines (https://www.cal-ipc.org/resources/library/publications/ipcw/report38/), so the limited and targeted use of herbicides on thistle is unlikely to be passed onto mountain lions. Likewise, giant reed is considered to be highly "deer resistant" (https://njaes.rutgers.edu/deer-resistant-plants/), so the limited and targeted use of herbicides on giant reed in the future also is unlikely to be passed onto mountain lions.

Other Protective Measures and Management

In addition to habitat conservation measures and the Invasive Species Control Plan that address the management and recovery recommendations in the Petition, the SSHCP provides for several other protective measures and management actions that will ensure the availability of the suitable live-in and movement habitat in the Habitat Reserve for mountain lions.

- An overall Habitat Reserve Management Program, which includes adaptive management of suitable habitat for the mountain lion, such as oak woodlands, riparian communities, chaparral and coastal sage scrub, as well as wildlife linkages and corridors.

- Public and HOA education programs regarding living with native wildlife including mountain lions, Habitat Reserve access restrictions, public education signage regarding Habitat Reserve access restrictions (i.e., no unauthorized access) and prohibitions on dogs in the Habitat Reserve.

- A Habitat Restoration Plan (Appendix H to the SSHCP).

- A Wildland Fire Management Plan (Appendix N to the SSHCP).

- County Ongoing Management Plans for Caspers Wilderness Park and Thomas Riley Wilderness Park (Appendix F to the SSHCP).

- Construction avoidance and minimization measures implemented through Biological Resources Construction Plans that include specific measures to avoid and minimize impacts to sensitive species and resources, such as any active mountain lion denning sites within or near planned construction sites (Appendix U to the SSHCP).

Future Management Measures by Others

RMV has identified several future management measures by other entities, that RMV would support, that could build on the SSHCP Conservation Strategy and directly benefit the SAM population. These measures include:

1. Installation of wildlife exclusion fencing along State Route 74 (SR-74/Ortega Hwy).

SR-74 is a two lane rural highway operated by Caltrans that provides access between Riverside and Orange counties. Average daily trips on this road are 22,000 vehicles. Studies cited in the Petition have identified that vehicle strikes account for a high proportion of deaths in mountain lions in the SAM, increasing the risk of extinction. Vickers (2015, cited in the Petition) has documented vehicle strikes on SR-74. On the portion of SR-74 within RMV lands there are two large culvert crossings that provide opportunities for mountain lions to cross under the highway; however, there is no fencing in place that would push lions to using these culverts. The lack of exclusionary fencing results in lions opportunistically crossing the highway at grade. A management measure to address this issue would be the installation of wildlife exclusion fencing along appropriate sections of SR-74 by Caltrans.

2. Support and provide funding for population estimate studies of mountain lions in the SAM.

RMV has previously provided a letter of support for the NCCP Local Assistance Grant Program application submitted by Dr. Winston Vickers of UC Davis for the study titled: *Estimation of the population of mountain lions in the Santa Ana Mountains and comparison of techniques for population estimation and DNA collection, wildlife photo technology development, and development of a long-term monitoring plan and collaborations for mountain lion populations in regional NCCP's.* Studies such as this should be funded.

3. Support the provision of a functional wildlife crossing of I-15 to connect the SAM and EPR mountain lion populations.

The Petition identifies I-15 as significant barrier to mountain lion movement between the SAM and EPR, thus contributing to the SAM mountain lion population risk of extirpation. According to the Petition, this risk is primarily due to its small inherent population size and the lack of interchange between the SAM and EPR populations needed to prevent inbreeding, in combination with human-caused mortality due to vehicle strikes, depredation kills, and other factors within the SAM range. Vickers et al. (2015, cited in the Petition) documented only one radio-collared mountain lion crossing between EPR and SAM in the last 13 years, and this individual was killed 25 days later for depredating sheep. Gustafson et al. (2017, as cited in the Petition) documented three males moving from the EPR to the SAM over 15 years, but only one successfully bred. According to the Petition, with inbreeding depression, it is projected that the SAM population will likely be extirpated within 50 years. A viable wildlife crossing of I-15 would therefore seem essential to the viability of the SAM population.

Summary and Conclusion

RMV understands the current and future risk to the SAM mountain lion population, primarily due to the inherent small population size and adverse effects of inbreeding and human-caused mortality. For this reason RMV has made a substantial effort toward conserving mountain lion habitat in the SSHCP Habitat Reserve. During the SSHCP planning process, and associated CEQA and NEPA reviews, RMV thoroughly considered the available information regarding mountain lion habitat use and movement in the SSHCP planning area, which is a relatively small subset of the SAM range used by mountain lions. As discussed in detail above, the SSHCP provides for comprehensive conservation and management of the species within the Habitat Reserve, including providing for and maintaining mountain lion movement via natural habitat linkages and corridors, and large bridge and culvert crossing structures. In addition, RMV has coordinated with, and supported, Dr. Vickers more recent work on mountain lions in the region, and supports future work by Dr Vickers.

As described above, live-in habitat within the SSHCP in the San Mateo Watershed portion of the planning area and Verdugo Canyon in the San Juan Creek Watershed provides about 25-30 percent of an average mountain lion home range in the SAM, and thus has a limited, albeit important, contribution to the overall viability of the SAM population, estimated in the Petition to be approximately 29 individuals (Benson et al. 2019, as cited in the Petition). As the sole owner and manager of more than 16,500 acres of the 32,800-acre Habitat Reserve, RMV is able to effectively protect and manage important habitat for the mountain lion in the SAM range through open space dedication and implementation of the HRMP. Therefore, RMV believes that the SSHCP adequately addresses the needs of the mountain lion within its portion of the SAM population. If the mountain lion is listed under CESA, the SSHCP should be recognized as contributing to the protection and management of the SAM population.

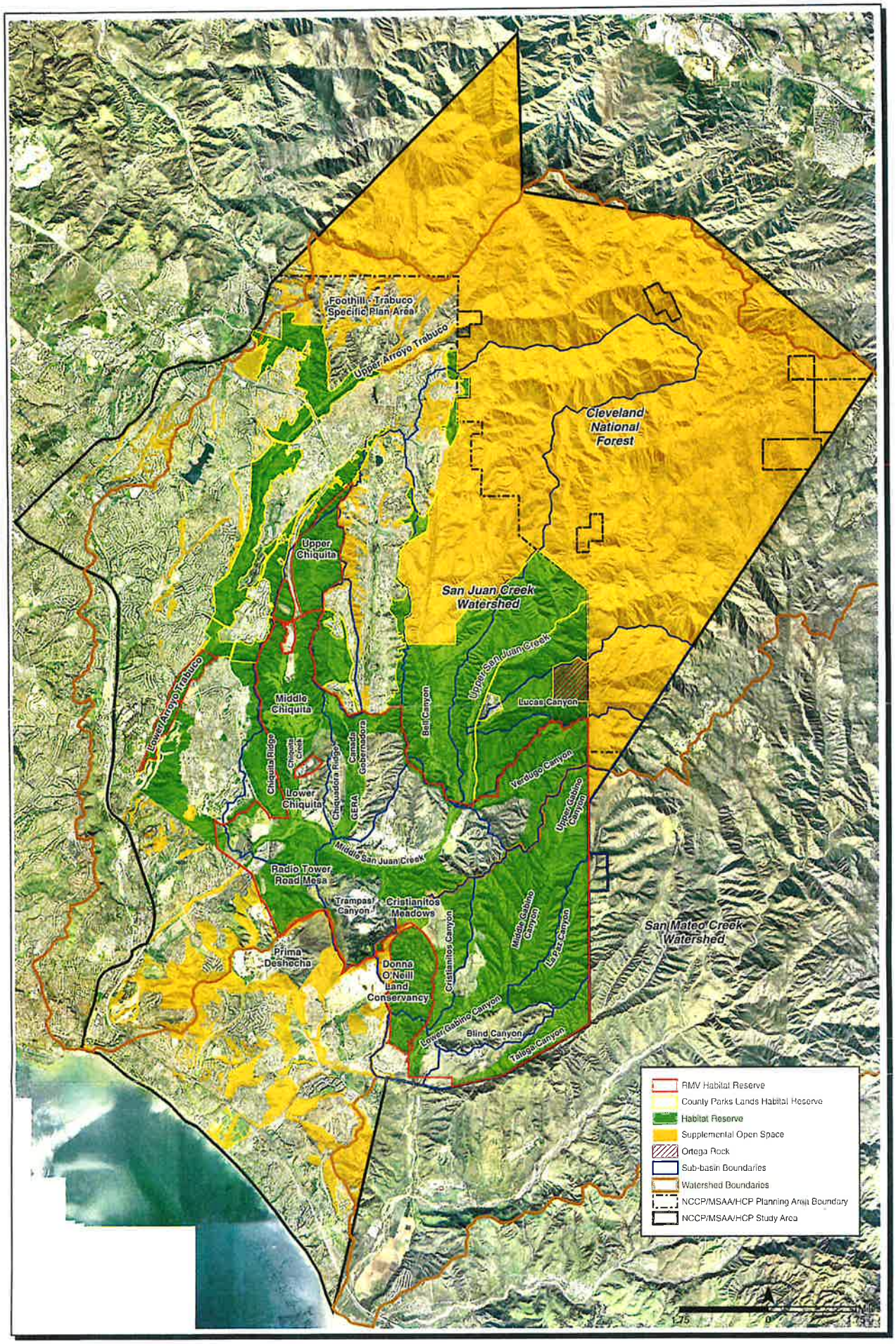
RMV appreciates the opportunity to provide these comments. Should you have any questions regarding our comments, please feel free to contact me at (949) 240-3363 Ext. 297 or via email at lcoleyeisenberg@ranchomv.com.

Sincerely,

Laura Coley Eisenberg
Senior Vice President, Open Space & Resource Management

Attachments

SSHCP Figures 169-M, 155-M & 159-M



NCCP/MSAA/HCP

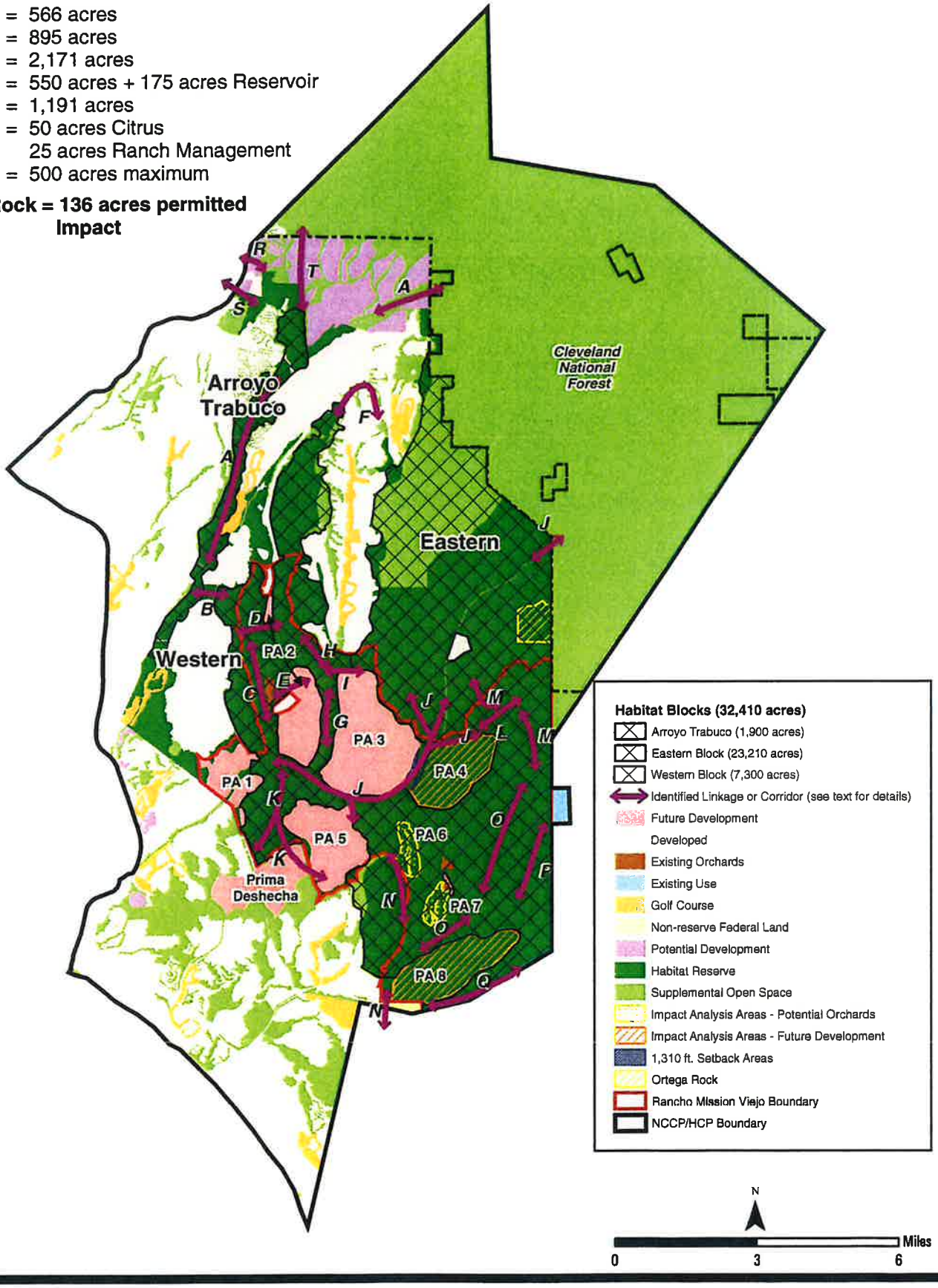
Habitat Reserve with Major Landscape Features

FIGURE 169-M

Planning Area Development

PA 1 = 566 acres
PA 2 = 895 acres
PA 3 = 2,171 acres
PA 4 = 550 acres + 175 acres Reservoir
PA 5 = 1,191 acres
PA 6,7 = 50 acres Citrus
25 acres Ranch Management
PA 8 = 500 acres maximum

Ortega Rock = 136 acres permitted Impact



NCCP/MSAA/HCP

Alternative B-12 Habitat Blocks with Habitat Linkages & Wildlife Corridors

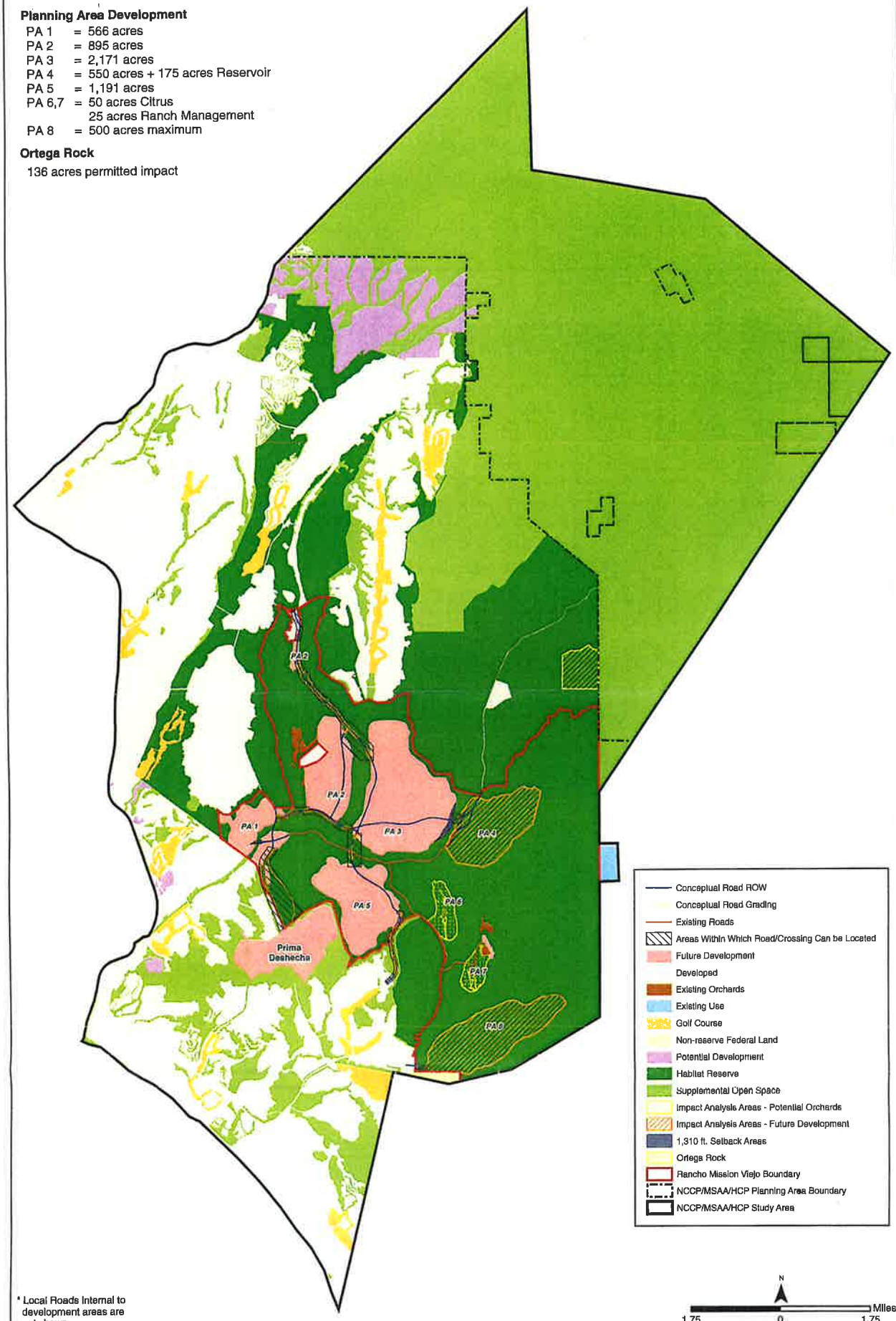
FIGURE 159-M

Planning Area Development

PA 1 = 566 acres
PA 2 = 895 acres
PA 3 = 2,171 acres
PA 4 = 550 acres + 175 acres Reservoir
PA 5 = 1,191 acres
PA 6,7 = 50 acres Citrus
25 acres Ranch Management
PA 8 = 500 acres maximum

Ortega Rock

136 acres permitted impact



* Local Roads Internal to development areas are not shown.

NCCP/MSAA/HCP

Alternative B-12 with Proposed Circulation System

FIGURE 155-M

COMMITTEES
VICE CHAIR: APPROPRIATIONS
VICE CHAIR: GOVERNMENTAL ORGANIZATION
INSURANCE
HEALTH
WATER, PARKS AND WILDLIFE

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March 19, 2020

Eric Sklar, President
California Fish and Game Commission
1416 9th Street, Room 1320
Sacramento, CA 95814

RE: Petition to list mountain lion (Puma concolor) as a threatened or endangered species under CESA. (Pursuant to Section 2073.3, Fish and Game Code, and subsection 670.1(c), Title 14, CCR)

Dear President Sklar,

As a representative of California, I write to address the Commission in response to a petition to list Southern/Central Coast Evolutionarily Significant Unit of Mountain Lions as threatened under the California Endangered Species Act as submitted by the Center for Biological Diversity and the Mountain Lion Foundation.

The proud ranchers of California take the responsibility for the proper care of their livestock including providing the necessary food, water and attention to raise healthy livestock. Part of this responsibility includes protecting livestock from predators. Mountain lions pose a significant threat to livestock and domestic animals in California. Representing 34.3 percent of cattle killed by predators, mountain lions can kill a large number of animals in a single night. Existing depredation permits allow for the protection of livestock and domestic animals that works in a meaningful way for ranch and farm owners or managers. Putting obstacles or further burdens on a rancher's ability to protect their livestock places at risk their ability to put food on the table of millions of people.

The proposed action that lists the specific unit of mountain lions as a candidate species will immediately place strict obstacles for the ability of farmers and ranchers to utilize the take permit process. If the Fish and Game Commission determines that the petitioned action may be warranted then these mountain lions are considered "candidate species." Candidate species are given the full range of protections afforded to threatened or endangered species under CESA, which will put at risk the existing process of protecting livestock from mountain lions along the central and southern coasts. California's farmers and ranchers

provide food and fiber to consumers internationally, and moving forward with the petition will create severe obstacles for the protection of livestock.

I urge the Commission to make a determination that no action is warranted in regards to the petition at your next hearing on April 15-16, 2020, or any subsequent hearing which would immediately establish mountain lions as a "candidate species" for listing. By doing so, the Commission will ensure that a proven process that allows for a rapid response to mountain lion attacks will remain.

Sincerely,

Frank Bigelow
5th Assembly District

COMMITTEES
VICE CHAIR: APPROPRIATIONS
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Assembly
California Legislature

FRANK BIGELOW
ASSEMBLYMEMBER, FIFTH DISTRICT

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March 19, 2020

Eric Sklar, President
California Fish and Game Commission
1416 9th Street, Room 1320
Sacramento, CA 95814

RE: Petition to list mountain lion (Puma concolor) as a threatened or endangered species under CESA. (Pursuant to Section 2073.3, Fish and Game Code, and subsection 670.1(c), Title 14, CCR)

Dear President Sklar,

As a representative of California, I write to address the Commission in response to a petition to list Southern/Central Coast Evolutionarily Significant Unit of Mountain Lions as threatened under the California Endangered Species Act as submitted by the Center for Biological Diversity and the Mountain Lion Foundation.

The proud ranchers of California take the responsibility for the proper care of their livestock including providing the necessary food, water and attention to raise healthy livestock. Part of this responsibility includes protecting livestock from predators. Mountain lions pose a significant threat to livestock and domestic animals in California. Representing 34.3 percent of cattle killed by predators, mountain lions can kill a large number of animals in a single night. Existing depredation permits allow for the protection of livestock and domestic animals that works in a meaningful way for ranch and farm owners or managers. Putting obstacles or further burdens on a rancher's ability to protect their livestock places at risk their ability to put food on the table of millions of people.

The proposed action that lists the specific unit of mountain lions as a candidate species will immediately place strict obstacles for the ability of farmers and ranchers to utilize the take permit process. If the Fish and Game Commission determines that the petitioned action may be warranted then these mountain lions are considered "candidate species." Candidate species are given the full range of protections afforded to threatened or endangered species under CESA, which will put at risk the existing process of protecting livestock from mountain lions along the central and southern coasts. California's farmers and ranchers

provide food and fiber to consumers internationally, and moving forward with the petition will create severe obstacles for the protection of livestock.

I urge the Commission to make a determination that no action is warranted in regards to the petition at your next hearing on April 15-16, 2020, or any subsequent hearing which would immediately establish mountain lions as a "candidate species" for listing. By doing so, the Commission will ensure that a proven process that allows for a rapid response to mountain lion attacks will remain.

Sincerely,

Frank Bigelow
5th Assembly District

From: Ackley, Hannah <Hannah.Ackley@asm.ca.gov>
Sent: Wednesday, April 1, 2020 12:30 PM
To: FGC <FGC@fgc.ca.gov>
Cc: Masingale, Katie <Katie.Masingale@asm.ca.gov>
Subject: Assemblyman Bigelow asks for delay in consideration of mountain lion petition

Hi there –

I hope you are safe and well during this time. I am reaching out on behalf of my boss, Assemblyman Bigelow, regarding a request from the entities in the attached letter. As a representative of many living in rural areas, he would like to reiterate their ask for a delay in the Commission's consideration of listing the mountain lion (Puma concolor) as a threatened or endangered species under the California Endangered Species Act. As the letter details, folks potentially impacted by the decision who would appreciate the opportunity to participate in the regulatory process may not have the ability to do so if the hearing is held digitally. This is unfortunate, and something we recognize is an access issue in our district. With that said, he is supportive of this agenda item being moved to a later date.

Thank you for your consideration, and please let me know if you have any questions at all.

Best,
Hannah

Hannah Ackley, *Legislative Director*
Office of Assemblyman Frank Bigelow
Main: (916) 319-2005 | Fax: (916) 319-2105
Capitol Office: Suite 4158

From: Ackley, Hannah
Sent: Thursday, March 19, 2020 1:14 PM
To: 'fgc@fgc.ca.gov' <fgc@fgc.ca.gov>
Cc: Masingale, Katie <Katie.Masingale@asm.ca.gov>
Subject: Assemblyman Bigelow comments opposing petition to list mountain lion (Puma concolor) as a threatened or endangered species under CESA

Hi there –

Please see the attached letter for your April meeting. Feel free to connect if you have any questions at all!

Thanks!
Hannah

Hannah Ackley, *Legislative Director*
Office of Assemblyman Frank Bigelow
Main: (916) 319-2005 | Fax: (916) 319-2105
Capitol Office: Suite 4158

March 26, 2020

Eric Sklar, President
California Fish and Game Commission
1416 9th Street, Room 1320
Sacramento, CA 95814

Re: Request to delay consideration of mountain lion CESA petition

President Sklar and Commissioners:

The above-identified organizations represent farmers, ranchers, and other rural county residents who would be most significantly impacted by the Commission's decision whether listing of mountain lions in the Central Coast and Southern California as threatened under the California Endangered Species Act "may be warranted." Our organizations recognize that the current COVID-19 public health crisis has necessitated a shift from in-person hearings to remote policymaking, and we commend the Commission for taking diligent action to safeguard the health of its members, staff, and constituents. But while many of our Central Coast and Southern California members had earlier in the year expressed an eagerness to drive to Sacramento to appear in person at the Commission's hearing, we are concerned that shifting April's Commission hearing to a "Teleconference/Webinar" format will exclude those stakeholders from meaningful involvement in the policy process. We therefore respectfully request that the Commission delay its consideration of the mountain lion petition until its June 24-25 hearing.

The COVID-19 emergency has fundamentally and substantially altered the business and personal lives of all Californians. Many families are grappling with the closure of schools and day care facilities, educating and caring for their children while balancing a full work schedule. Many are adjusting to working from home full-time, and others to no longer working at all. Many are ill, whether with COVID-19 or with other maladies they fear could put them at added risk should they contract COVID-19. Given these enormous changes and concerns—and Californians' efforts to address and adapt to them—it may be difficult for many stakeholders to make time or otherwise arrange to meaningfully engage in the regulatory process at this time.

Additionally, many of your constituents who would be most significantly impacted by your finding as to whether listing "may be warranted" do not have reliable access to a webinar format. For instance, only 86.2% of San Luis Obispo County—which is fully within the ESU boundaries identified within the petition—is served by broadband internet. Many residents living in rural areas of San Luis Obispo County will not be able to access a Commission webinar, limiting their access to information provided by and to the Commission, including PowerPoint presentations, and limiting their ability to meaningfully participate in the hearing. In Kings County, which is within the ESU boundary west of I-5, broadband access is available in only 84% of the County. According to the Public Policy Institute of California, only 59% of rural households have broadband internet.

Moreover, the Governor's stay-at-home order precludes rural residents without broadband from making reasonable efforts to otherwise avail themselves of the webinar format. As a result of social distancing measures intended to "flatten the curve" of the COVID-19 crisis, rural residents cannot make use of their friends' or neighbors' electronic resources, nor can they use the resources of their local library, as most library branches have closed during the pandemic.

While the teleconference option would support greater participation than the webinar format, it remains problematic, as participation via teleconference would deprive participants of vital visual information presented in the hearing. Additionally, much of the rural landscape of the Central Coast and Southern California comprises cellular "dead zones" where residents lack reliable cellular reception to participate in a hearing via teleconference.

The Governor currently projects that the stay-at-home order could remain in effect for eight to twelve weeks. The Commission's June 24-25 hearing is outside of that twelve-week window, suggesting that it may be safe to proceed with an in-person public hearing at that time. Moreover, we note that the Commission's June hearing is scheduled to be held in Santa Ana, conveniently accessible to stakeholders on the Central Coast and in Southern California. Because the webinar/teleconference format would preclude the participation of impacted stakeholders, and because the June hearing would better facilitate the participation of those stakeholders, we respectfully request that the Commission delay its decision whether listing "may be warranted" until its June hearing.

Sincerely,

Kirk Wilbur
Vice President of Government Affairs
California Cattlemen's Association

Valerie Nera
Policy Advocate
California Chamber of Commerce

Sunshine Saldivar
Associate Counsel
California Farm Bureau Federation

Staci Heaton
Senior Regulatory Affairs Advocate
Rural Counties Representatives of California

Eco Synthesis
SCIENTIFIC & REGULATORY SERVICES, INC.

April 2, 2020

Via Electronic Mail to fgc@fgc.ca.gov
Fish and Game Commission
Attention: Melissa Miller-Henson, Executive Director
P.O. Box 944209
Sacramento, CA 94244-2090

Subject: Item 32 of April 15-16, 2020, Meeting Agenda - Mountain Lion CESA Petition: Consider and Potentially Act on the Petition, Department's Evaluation Report, and Comments Received to Determine Whether Listing Mountain Lion (*Puma concolor*) as a Threatened or Endangered Species Under CESA May be Warranted

Dear Commissioners,

At the request of several ranchers and farmers, I have reviewed the petition referenced above and wish to provide some comments for the California Fish and Game Commission's consideration. These comments are based upon over 40 years of critical reading and application of biological science and over 30 years of practical experience with environmental review and implementation of impact reduction and mitigation actions to benefit uncommon species, whether formally listed or not.

I concur with many of the petitioners' general comments on the ecological importance of top predators where landscapes contain a diversity of natural habitats, and excessive herbivore pressure has identifiable adverse effects on system integrity. And, having lived most of my life in mountain lion habitat with robust populations of them present, I have a strong appreciation for the value of the species as an inspiring symbol of the wildness still to be found in much of our state.

Petitioners state that the California Department of Fish and Wildlife (Department) is currently engaged in an effort to provide an updated estimate of mountain lion numbers throughout the state. In my opinion, it's a bit premature to make any final decision on listing an expansive ESU of the species prior to the Commission's having that important data to consider in its deliberations. Ideally, any listing decision at all should be deferred until that estimate is completed.

However, even absent updated estimates, I would bring several main points to Commissioners' attention:

- The most recent study of mountain lions in two small southern California occurrences, where numbers are undeniably low, shows that readily available management actions can preserve genetic diversity and protect against demographic risk.
- This being the case, the 50/500 (or 100/1000) "rule of thumb" that petitioners propose as a listing principle is not validly applied as a listing standard for mountain lions in California.

16173 Lancaster Place, Truckee, CA 96161 · Telephone: 530.412.1601 · E-mail: ajuncosa@ecosynthesis.com

- The largest component (Central Coast - Central or CC-C) of the expansive evolutionarily significant unit (ESU) proposed by petitioners consists of a large, viable subpopulation of mountain lions inhabiting a geographic area including extremely large, unbroken expanses of undeveloped habitat and as such does not warrant listing by itself or in combination with other subpopulations.
- In other respects, the recommended ESU circumscription and listing may not be appropriate.

Potential Viability of Small Populations in Southern California With Management

Benson et al. (2019) studied the demographics (simple numbers of individuals and reproductive individuals) and genetics (genetic diversity or heterozygosity) of two mountain lion subpopulations in southern California (Santa Monica Mountains [SMM], referred to by Gustafson, 2018, and the petition as the Central Coast - South or CC-S subpopulation; and Santa Ana Mountains [SAM]). They used observed numbers and genetic characteristics in multiple (5,000) random runs of computer models and show what the outcomes are over a period of up to 50 years. It's an excellent contribution, only a part of which is summarized here.

The authors identify potential demographic and genetic risks to the two subpopulations, but state unequivocally that "Mountain lions are not endangered in southern California" though admittedly they are scientists rather than legal or regulatory experts. The most significant finding of their modeling, however, is how few individual immigrant (or translocated) mountain lions are needed to protect the long-term demographic and genetic prospects of the small populations they studied: only one individual every year or two. Other previous studies on mountain lions and the Florida panther have found similar results, that very few additional individuals are necessary to preserve genetic diversity (Gustafson, 2017; Johnson, 2010). This is strongly at odds with petitioners' recommendation of a 50/500 or 100/1000 standard as the minimums that are necessary to preserve population viability. The point is not to discount that there may be any cause for concern, but only to dispute that mere low numbers alone are determinative.

In the short term, translocation is a much less expensive strategy, though it would be required to be repeated continually over time. Physical connections between habitat patches are more expensive but facilitate long-term connectivity without further intervention. On this subject, it is appropriate to add to petitioners' remarks about Florida panther, an eastern U.S. subspecies of *Puma concolor*. Restoration of the genetics and population numbers of this subspecies was achieved in part by translocation of individuals from Texas, a presently disjunct but formerly interbreeding subpopulation, so there is precedent for such action, and evidence of its effectiveness.

I think Benson et al. provide strong scientific rationale and extensive discussion of potentially feasible management actions, but conclude that "our results also provide reason for optimism, as seemingly realistic increases in gene flow appear sufficient to substantially reduce probability of extinction of top predators due to combined demographic and genetic threats within the second largest metropolitan area in the United States." This is the case even though there is no possibility of the subpopulations studied by these authors ever to attain the numerical threshold suggested by petitioners as a standard for listing.

That said, the question remains whether such management actions will be undertaken, independent of debate about what degree of endangerment exists. My personal opinion would be that attention

would be better focused on actually implementing beneficial management than on the listing process and its consequences; justifiably, lack of the former often leads to the latter.

Suggested Minimum Population (50/500 or 100/1000) Standard

Petitioners state that "conservation management practice over the past few decades has followed a 50/500 rule, which purports that an effective population size of 50 is sufficient to prevent inbreeding depression in the short term,...and an effective population size of 500 is sufficient to retain evolutionary potential in perpetuity." Not only do petitioners seems to imply that this should be established as a kind of regulatory precedent for listings, they further suggest that maybe the thresholds should be raised to 100/1000 on the basis of a review of the original semi-arbitrary standard. Simple numerical thresholds such as these may be appealing, but are a very slippery slope.

The concern regarding listing precedent is not imaginary: in the very petition currently on the Commission agenda, the precedent of the listing of the fisher ESU is cited (which, as I explain later, is not at all an analogous situation to that of mountain lions). Should the Commission act to list a mountain lion ESU (of whatever extent) on the basis of petitioners' recommended 50/500 or 100/1000 standard, there will certainly follow future petitions that urge similar action for other species on the same basis.

Large areas of southern California are entirely and irreversibly urbanized, such that mountain lion habitat is restricted to largely isolated patches. Petitioners state that the enormous geographic area of the CC-C subpopulation, including much more even than the 1.75 million acres of undeveloped habitat in the Los Padres National Forest alone, supports an effective population which they represent as being only barely viable (or not viable under the arbitrarily doubled standard that is cited). The entire geographic area of habitat available to the CC-S subpopulation is only 150,000 acres, so, under petitioners recommended viewpoint, this subpopulation cannot ever be anything but a non-viable zombie population, with no possibility of ever reaching the numbers that petitioners suggest are necessary for it to become viable. Similar comments pertain to five of the six subpopulations that petitioners recommend for inclusion in an expansive ESU. What is the agenda of listing if the standard means that none of the subpopulations can ever become viable again according to petitioners' suggested standard? The reasonable alternative is to reject the arbitrary standard and make case-by-case judgments, similar to the discussion above for CC-S.

As discussed above, feasible and highly beneficial management actions could be implemented, which preserve the demographic and genetic prospects of even the smallest southern California mountain lion subpopulations essentially in perpetuity, showing by species-specific, situation-specific scientific means that the petitioners' suggestion that listings should be based on the semi-arbitrary 50/500 (or 100/1000) standard is not valid. Petitioners themselves state that "fragmented populations should be evaluated on a case-by-case basis." Benson et al. (2019) did just that, and their conclusions were that it is feasible to prevent the risk of endangerment even in very small populations, essentially completely invalidating the petitioners' suggestion that listings should be based upon either arbitrary numerical standard.

In conclusion, it seems to me that available scientific information pertaining to *Puma concolor* subspecies suggests that reliance on petitioners' suggested numerical standards does not accurately represent population viability or lack thereof, for this species (and perhaps not for any others, without actual case-by-case evaluation).

Central Coast - Central (CC-C) Subpopulation

Petitioners identify possibilities for development within the area occupied by the CC-C subpopulation of mountain lions, but fail to mention that this area includes not only large areas that are presently undeveloped, but also the Los Padres National Forest, of 1.75 million acres (plus private inholdings), almost half of which is designated wilderness. (Some of the Forest lies outside the limits of the CC-C subpopulation, but the vast majority is within it.) Neither loss or fragmentation of habitat, nor kills from vehicle strikes or depredation permits pose either an imminent or a distant future threat to the demographic or genetic viability of the CC-C population. Including this robustly viable and large population within a listing decision is neither appropriate nor wise from the perspective of future regulatory consistency.

One substantial impact on habitat within undeveloped areas in the CC-C geographic area is large wildfires. Fires have a diversity of effects on habitat in California, which vary between predominantly conifer forest and predominantly shrubland regions. Though small, patchy, or lower intensity fires can be followed by ecological succession that is beneficial to mountain lion prey species, large ones cause more severe and extensive habitat losses. Mountain lions are secretive, wide-ranging, and not easy to study. If the species were to be listed in the CC-C area, is it reasonably foreseeable that actions to compel the collection of site-specific information about them would greatly complicate and delay ecologically sound landscape management to try to reduce the geographic extent of wildfires, when they do inevitably occur. This could ultimately be to the detriment, not the benefit, of the species.

Should the Commission determine that the petition justifies listing of any subpopulations of mountain lion, I would hope that this would be directed toward geographic areas where the actual definitions in CESA might be satisfied, and not include any areas where they are not just for purported management convenience.

Circumscription and Listing of the Proposed ESU

Petitioners justify their suggested circumscription of an ESU of mountain lion for listing based upon several premises, some of which seem invalid to me. Petitioners note that the Southern Sierra Nevada ESU of (Pacific) fisher (*Martes [Pekania] pennati*) was listed, but before 1989-1994, that population was already geographically disjunct by about 250 miles from any other extant occurrence, and therefore genetically isolated, probably forever (Zielinski et al., 1995). The circumstances of the suggested ESU for mountain lion are not analogous at all, especially one that is so expansively defined. The listing as proposed by petitioners would be a dramatic expansion of the practice of listing portions of the ranges of California species, a precedent that should be carefully considered before it is set.

Petitioners' Table 1 would not support a determination that the ESU as a whole is at demographic or genetic risk (even under the numerical standards that are suggested), calling into question why listing of this whole portion of the species' population is requested at this time. Hypothetically, one might suggest that the concerns pertaining to the southern California subpopulations, which do not apply to the CC-C subpopulation, mean that the requested inclusion of the latter is justified because there is risk to the species throughout a significant part of its range. I would dispute this line of reasoning, because it would be equally true if the entire statewide range of the species were considered, not just the six subpopulations the petitioners suggest as an ESU to be listed.

Petitioners allow that the degree of threat to mountain lion population viability is not uniform throughout their suggested ESU, seemingly acknowledging (though I may be misrepresenting, and apologize if so) that the CC-C subpopulation and maybe others do not warrant listing. Instead, they state that the circumscription and listing of the suggested ESU is based on being "the most pragmatic from a management perspective." I do not agree that it is pragmatic at all to lump mountain lion management in the Los Angeles metropolitan area together with management in the sparsely developed CC-C area.

Practical and Other Considerations

Given that the petition urges the recognition of an expansive ESU on the basis of management considerations as much as (or perhaps more than) on a basis of genetics, it is well for the Commission to consider some points pertaining to management in evaluating it.

First and foremost, listing is a paper process only, from which no species benefits unless protective or beneficial actions are taken in its habitat. Petitioners and sources they and I both cite provide a list of management recommendations, many of which seem to me to be feasible and potentially effective in achieving the goal of preserving a future for the mountain lion in the areas where their numbers are low. Even with listing, none of these will happen without commitment at the state and local levels to make these actions happen.

I would urge the Commission to consider opportunities to go directly to making these management recommendations happen without the need for substantial expenditure of effort and funds on all sides on legal processes surrounding listing and its consequences. There aren't a lot of successful examples of this kind of pragmatic approach, but it is possible and merits attention. It seems to me that many of petitioners' recommendations could be implemented without need for listing in most of the geographic range of the suggested ESU. Any of these that fall within the Commission's purview should be discussed in the context of evaluating the petition.

More particularly, the management responses in different geographic areas within the petitioners' suggested ESU. Urbanization and infrastructure design/management is a much more relevant issue in some areas than in others; elsewhere, petitioners express concern about possible levels of depredation or illegal kills. It is dubious whether *any* of these concerns are truly applicable in the large CC-C area. The divergence of management subjects seems inconsistent with the suggestion that a single expansive coastal ESU is justified on the basis of management response.

On a personal level, having spent a lot of time in ranching settings and with ranchers in California and Nevada, I am convinced that universally they would like the lands they own or have grazing permits on to stay as they are, basically undeveloped, and used for pasture based or dispersed grazing. But no agricultural business is easy, and when it becomes infeasible to maintain a viable business on expanses of undeveloped land, the many forces that favor urbanization and highways become impossible to withstand. It's no single entity's responsibility or fault, it just happens that way. These kinds of practical consequences are worthy of the Commission's consideration in evaluating the petition. Petitioners themselves identify the potential for residential development of existing large ranches in some locations (if I recall correctly, specifically in the CC-North area) as a concern. I am not in a position to state with any authority or assurance whether listing would make such changes more, or less, likely, but would urge the Commission to consider the question.

I share petitioners' desire to preserve viable populations of mountain lions throughout their range in California, but feel that deferring until better population estimates are available is prudent; that, if any, a more targeted listing action is more appropriate than an expansive ESU designation and listing; and that much more attention should be focused on any ways in which the Commission can facilitate implementation of beneficial management actions, irrespective of listing.

Sincerely,

Adrian Juncosa, PhD

Senior Ecologist

References

Benson, J.F., P.J. Mahoney, T.W.Vickers, J.A. Sikich, P. Beier, S.P.D. Riley, H.B. Ernest, and W.M. Boyce. 2019. Extinction vortex dynamics of top predators isolated by urbanization. *Ecological Applications* 29(3):e01868. 10.1002/eap/1868.

Gustafson, K.D., T.W. Vickers, W.M. Boyce, and H.B. Ernest. 2017. A single migrant enhances the genetic diversity of an inbred puma population. *Royal Society Open Science* 4:170115.

Gustafson, K.D., R.B. Gagne, T.W. Vickers, S.P.D. Riley, C.C. Wilmers, V.C. Bleich, B.M. Pierce, M. Kenyon, T.L. Drazenovich, J.A. Sikich, W.M. Boyce, and H.B. Ernest. 2018. Genetic source-sink dynamics among naturally structured and anthropogenically fragmented puma populations. *Conservation Genetics* 20:215-227. https://doi.org/10.1007/s10592-018-1125-0.

Johnson, W.E., D.P. Onorato, M.E. Roelke, E.D. Land, M. Cunningham, R.C. Belden, R. McBride, D. Jansen, M. Lotz, D. Shindle, J. Howard, D.E. Wildt, L.M. Penfold, J.A. Hostetler, M.K. Oli, and S.J. O'Brien. 2010. Genetic restoration of the Florida panther. *Science* 329:1641-45. doi: 10.1126/science. 1192891.

Zielinski, W.J., T.E. Kucera, and R.H. Barrett. 1995. Current distribution of the fisher, *Martes pennanti*, in California. *California Fish and Game* 81(3): 104-112.

From: Kirk Wilbur <kirk@calcattlemen.org>
Sent: Tuesday, March 31, 2020 1:00 PM
To: FGC <FGC@fgc.ca.gov>
Subject: Mountain Lion Listing Opposition (Item #32)

To whom it may concern:

Please find attached nine letters from CCA members in opposition to CESA listing for Southern California and Central Coast mountain lions (April 16th agenda item #32). **If you would please reply to this email to confirm receipt of these letters and to confirm their inclusion in the members' binder materials for the meeting**, it would be greatly appreciated.

Additionally, on Thursday the 26th I transmitted a letter requesting that the Commission delay its consideration of the mountain lion petition. **If you would likewise confirm receipt of that letter,** as well, I would greatly appreciate it.

Sincerely,

Kirk Wilbur
Vice President of Government Affairs
California Cattlemen's Association
1221 H Street, Sacramento, CA 95814
(916) 444-0845

From: Kirk Wilbur <kirk@calcattlemen.org>
Sent: Thursday, April 2, 2020 9:43 AM
To: FGC <FGC@fgc.ca.gov>
Subject: Additional Livestock Producer Letters (Item #32)

To whom it may concern:

In addition to the nine letters from CCA members and livestock producers transmitted to the Commission via email on Tuesday the 31st, please find attached **two additional letters** from livestock producers in opposition to CESA listing for Southern California and Central Coast mountain lions (April 16th agenda item #32). **If you would please reply to this email to confirm receipt of these letters and to confirm their inclusion in the members' binder materials for the meeting**, it would be greatly appreciated.

Sincerely,

Kirk Wilbur
Vice President of Government Affairs
California Cattlemen's Association
1221 H Street, Sacramento, CA 95814
(916) 444-0845

Mr. Eric Sklar
California Fish and Game Commission
1416 9th Street, Room 1320
Sacramento, CA 95814

via email

Dear Commissioners,

As a rancher, farmer, and property owner in both the Santa Monica Mountains and the San Joaquin Valley, I would like to express my concern in listing mountain lions as endangered under the California Endangered Species Act (CESA).

I wholeheartedly agree with the California Cattlemen's Association's position that such a listing would be in violation of state law. Aside from that, my experience with mountain lions is that they do not qualify, nor would they benefit from the protections that CESA offers.

In my experience, the lions in Central California are larger, stronger, smarter, and more intuitive than those in the heavily populated areas of Southern California. Due to the more rural settings, they have had to compete for limited resources, harsher conditions, and therefore have evolved into genetically superior animals. Lions in Central California are naturally cautious around humans and vehicles and the ability for issuing depredation permits helps maintain this genetic superiority through "culling" those animals that must to resort to scavenging for resources.

On the other hand, the Santa Monica Mountains and surrounding recreational areas are not appropriate habitats for these predators and that fact can be seen through inbreeding, close proximity to urban areas, and smaller habitat size. For these reasons, the lions in Southern California are smaller, more comfortable around humans and vehicles, and are only able to maintain body condition by scavenging off of domestic water and food sources. Protecting this dynamic under the CESA will only HURT the genetic diversity of the mountain lion population.

Everyone appreciates nature and animals, but farmers, ranchers, and other property owners are what maintain the REAL habitat for mountain lions. **Protecting property rights is the best way to incentivize sustainable habitat and wildlife populations** and for that reason I believe even the current "three strikes" policy is counterproductive.

I understand the political pressure the Commission faces from Southern California representatives like LA County Supervisor Sheila Kuehl and LA City Councilmen Paul Koretz and David Ryu, but they do not have the jurisdictional authority nor the proper environmental understanding on this matter. Even with the vast amount of resources these representatives have at their disposal, they have not demonstrated the ability to maintain thriving wildlife habitats within their own affluent jurisdictions, regardless of the amount of money they spend. These are the same representatives that are pushing for a "wildlife" bridge over a

freeway in Southern California at a price tag equal to THREE TIMES the entire State's budget on protecting mountain lions... Which dollars do you think have the most impact in helping lion population? Please do not let the misguided intentions of these few urban representatives and few very vocal constituents guide this Commission's decisions on state wildlife protections.

Thank you for your consideration,

Wes Myers

From: Misty McNamara [redacted]
Sent: Monday, February 24, 2020 09:39 PM
To: clerkoftheboard@ventura.org <clerkoftheboard@ventura.org>; Steve.Bennett@ventura.org <Steve.Bennett@ventura.org>; Linda.Parks@ventura.org <Linda.Parks@ventura.org>; John.Zaragoza@ventura.org <John.Zaragoza@ventura.org>; kelly.long@ventura.org <kelly.long@ventura.org>; supervisor.huber@ventura.org <supervisor.huber@ventura.org>; FGC <FGC@fgc.ca.gov>
Subject: BOS 2/25 - OPPOSED - RESOLUTION OF THE BOARD OF SUPERVISORS -MOUNTAIN LIONS

RESOLUTION OF THE BOARD OF SUPERVISORS OF THE COUNTY OF VENTURA PROCLAIMING SANTA MONICA MOUNTAINS MOUNTAIN LIONS IN NEED OF EXPANDED PROTECTIONS

TO: Ventura County Board of Supervisors

I strongly urge you to vote no on this resolution. This resolution has no reference to any facts on the numbers; number of actual lions in Ventura County; number of attacks on livestock; number of attacks on humans; number of attacks on pets; number of lions needing relocation; number of sightings in residential areas; number of depredation permits issued; number of depredation permits that resulted in a lion being taken. Your resolution is based solely on ONE (1) lion being taken, and lets clarify that it is not 1 of only 2 lions in the Santa Monica Mountain Range, it is one of two that are collared. Most all of the recent sightings of mountain lions in our local communities, recorded by home surveillance cameras and police video, are UN-collared lions. Your resolution needs scientific data that shows the lion population has decreased or is declining! Based on the recent huge influx of sighting and attacks in our local neighborhoods, it appears that low population is not a problem!

As to eliminating the ability to get a depredation permit in Ventura County, that would be "irresponsible" management and a threat to public safety. So, Lets talk about being "Responsible" - Only 5 depredation permits have been issued in Ventura County from 2009-2016, from those permits, 0(zero) lions were "taken". It is clear that livestock producers in Ventura County have not and do not abuse the depredation permit process. As a livestock producer, a depredation permit is a tool that would only be used if necessary. But eliminating our access to this tool is detrimental to our CROP.

I strongly oppose the resolution of the "Ventura County Board of Supervisors hereby includes in its 2020 State Legislative Agenda and Platform support or sponsorship of legislation and/or administrative action to end the issuance of depredation permits in Ventura County for mountain lions that attacked livestock and other animals; and that the County of Ventura supports legislative or executive action to support the listing of the Southern /Central Coast Evolutionary Significant Unit (ESU) of Mountain Lions at Threatened under the California Endangered Species Act as recommended by the California Department of Fish and Wildlife."

Misty McNamara

HORAN | LLOYD

ANTHONY T. KARACHALE
STEPHEN W. DYER
MARK A. BLUM
JAMES J. COOK
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File No. 17.316

April 2, 2020

Via Electronic Mail; fgc@fgc.ca.gov
Fish and Game Commission
Attn: Melissa Miller-Henson Executive Director
P.O. Box 944209
Sacramento, CA 94244-2090

RE: Item 32 of April 15-16, 2020 Meeting Agenda - Mountain Lion CESA Petition: Consider and Potentially Act on the Petition, Department's Evaluation Report, and Comments Received to Determine Whether Listing Mountain Lion (*Puma Concolor*) as a Threatened or Endangered Species under CESA May be Warranted

Honorable Commissioners:

This firm represents several ranchers and farmers in the Central Coast and Central Valley. This letter is to comment on "A Petition to List the Southern California/Central Coast Evolutionarily Significant Unit (ESU) of Mountain Lions as Threatened under the California Endangered Species Act (CESA)" ("Petition") submitted by the Center for Biological Diversity and the Mountain Lion Foundation ("Petitioners").

It is clear, as further explained in the body of this letter, that the listing of mountain lion as threatened as requested in the Petition would be in direct conflict with and would result in unconstitutional amendments to the initiative statute (Proposition 117). Accordingly, your Commission is without any discretion other than to deny the Petition on that basis.

In 1990, Proposition 117, referred to as the California Wildlife Protection Act, passed by a slim voting margin of fifty-two percent to forty-eight percent. The original text of Proposition 117 includes the following important provisions, which clearly indicate the electorate's intent in narrowly passing the initiative: (1) designate mountain lions as a specially protected mammal and ban mountain lion hunting (section 4800); (2) create Habitat Conservation fund (section 2786); (3) under a depredation permit, allow the removal or take of a mountain lion that is perceived to pose an imminent threat to public health or safety (section 4801); and (4) allow the "pursuit", " capturing, injuring, or killing" of a mountain lion by a person or employee or agent

of a person, whose livestock or other property is being or has been injured, damaged, or destroyed by a mountain lion (Sections 4802 – 4808). Sections 4802 through 4808 (Item 4 above) of the original text were included in the initiative to ensure that property (which includes livestock, domestic animals and real property) could be adequately protected by property owners and operators. These initiative statute sections would be in direct conflict with and would be unconstitutionally voided should mountain lion be listed as threatened under the California Endangered Species Act ("CESA") pursuant to the Petition.

In fact, under the original text of Proposition 117, as codified in Fish and Game Code, "any mountain lion that is encountered while in the act of pursuing, inflicting injury to, or killing livestock, or domestic animals, may be taken immediately by the owner of the property or the owner's employee or agent". (Emphasis added; section 4807(a).) Moreover, oral authorization from the California Department of Fish and Wildlife ("CDFW") is allowed for the pursuit and take of a depredating mountain lion. (Section 4805.) These provisions clearly indicate an urgency on the part of CDFW to expedite the approval process for mountain lions believed to be responsible for depredation. Other provisions such as, "the confirmation process [by the CDFW] shall be completed *as quickly as possible*, but in event more than 48 hours after receiving the report" (emphasis added; Fish and Game Code §4803), further indicates the urgent and expedited depredation approval process afforded in Proposition 117 in order to protect property and lives.

Rather than continue the electorate's intent to provide an expedited depredation approval process as set forth in the initiative statute, the listing of mountain lion under CESA would, in essence, prohibit the "take" of any mountain lions in Southern and Central Coast California even if property and lives are in imminent danger. Under CESA, "take" incidental to otherwise lawful activities may be allowed only if such activity is not likely to jeopardize the continued existence of the species; if certain cumbersome and robust conditions are met; and an incidental take permit is obtained, which process is certainly not considered expeditious. The cumbersome and costly process simply to protect property and lives is clearly in conflict with the electorate's intent in passing Proposition 117.

The Petitioners may invalidly argue that Proposition 117 is intended to protect mountain lions and the listing would further the intent of the electorate. Such an argument is without merit. Case law has made clear electorate's intent in passing initiative is determined by looking at the plain language of the initiative itself. (*People v. Florez* (2005) 33 Cal.Rptr.3d 632.) The *Florez* court explained:

> [I]t does not matter whether the voters consciously considered all the effects and interrelationships of the provisions they enacted. We must take the language as it was passed into law, without doing violence to the language and spirit of the law, interpret it so as to harmonize and give effect to all its provisions. (Emphasis added; *ibid* at p. 638.)

Only when the language in an initiative statute is ambiguous, do the courts consider extrinsic evidence. The *Florez* court further explained:

> In interpreting a voter initiative, a court applies the same principles that govern statutory construction. Thus, the court turns first to the language of the statute, giving the words their ordinary meaning. The statutory language must also be construed in the context of the statute as a whole and the overall statutory scheme in light of the electorate's intent. When the language is ambiguous, the court refers to other indicia of the voters' intent, particularly the analyses and arguments contained in the official ballot pamphlet. In other words, the court's task is simply to interpret and apply the initiative's language so as to effectuate the electorate's intent. (*People v. Florez* (2005) 33 Cal. Rptr. 3d 632, 634.)

The initiative statute provisions specific to an expedited depredation approval process are clear and unambiguous. The electorate, in approving Proposition 117, agreed to a balanced approach in protecting mountain lions – protect mountain lions by eliminating their hunting, but allow for an expediated process to take a depredating mountain lion in order to protect property and lives. The listing of mountain lion as threatened would unconstitutionally void the initiative statute's expedited depredation approval process in its entirety. The Commission cannot act inconsistent with the initiative statute without the State legislature seeking ratification by the electorates. Accordingly, the Commission has no choice other than to deny the Petition.

An approval of the Petition, as applied, would effectuate an unconstitutional amendment to the actual text of Proposition 117 which is in violation of article II, section 10, subdivision (c) of the California Constitution. Article II, section 10, subdivision (c) states in relevant part: "The Legislature may amend or repeal an initiative statute by another statute that becomes effective only when approved by the electors unless the initiative statute permits amendment or repeal without the electors' approval." Proposition 117 affords no authority to amend or repeal the initiative statute that is inconsistent with the Act, and any amendment consistent thereto must be by a vote of four fifths of the members of both houses of the State legislature.

The purpose of California's constitutional limitation on the legislature's power to amend initiative statutes is to protect the people's initiative powers by precluding the legislature from undoing what the people have done, without the electorate's consent. Courts have a duty to jealously guard the people's initiative power, and hence to apply a liberal construction to this power wherever it is challenged in order that the right to resort to the initiative process be not improperly annulled by a legislative body. (*People v. Kelly* (2010) 47 Cal. 4th 1008, 1025.)

It is clear from the rulings in *People v. Kelly* and *People v. Florez* that any judicial act that amends or repeals an initiative statute, as applied, is unconstitutional. The same logic would extend to any adjudicatory and legislative decisions by any governmental agency. The California Supreme Court in *People v. Kelly, supra,* 47 Cal. 4th 1008, 1026 determined that an amendment of an initiative statute for purposes of article II, section 10, subdivision (c) is "a

legislative act that changes an existing initiative statute by taking away from it." The listing of mountain lion under CESA is a legislative act that would take away from the initiative statute's expedited depredation permit process in violation of article II, section 10, subdivision (c).

The Petitioners may invalidly argue that the listing of mountain lion by this Commission is an administrative/adjudicatory decision not subject to article II, section 10, subdivision (c) of the California Constitution. This argument is also without merit. The court in *National Resources Defense Council* (1994) 28 Cal. App. 4th 1104 dismissed the argument that listing decisions by the Commission, pursuant to Fish and Game Code section 2074.2, is administrative. In comparing CESA to the California Environmental Quality Act's ("CEQA") substantial evidence standard, the court explained "a candidate under CESA contemplates a more formal, public, evidentiary and fact-finding process than does the determination of whether to prepare an EIR under CEQA." By the Commission's own conduct, the Commission agrees its listing decisions are not administrative, but rather legislative; otherwise, the Commission would have provided *actual* notices to all affected parties (i.e., more than half of the population in California) for these administrative hearings on the Petition, which the Commission did not do.

The court in *Natural Resources Defense Council v. Fish & Game Com., supra,* 28 Cal. App. 4th at p. 1128 discerned that the Commission's consideration of a petition to add a species to or remove a species from the list of endangered or threatened species as set forth Fish and Game Code section 2074.2 is quasi-adjudicatory -- one encompassing both adjudicative and legislative elements. The court explained, by citing the decision in *Horn* v. *County of Ventura* (1979) 24 Cal. 3d 605, "'adjudicatory' matters are which the government's action affecting an individual as determined by facts peculiar to the individual case and 'legislative' decisions involves the adoption of a broad, generally applicable rule of conduct on the basis of general public policy." (*Ibid* at p. 1128.) The legislative act of listing mountain lion as threatened would not only affect a few individuals, but instead, it would broadly affect more than half of the population in the State of California by regulating their conduct. Because the Commission's decision is legislative in nature, it is subject to article II, section 10, subdivision (c) of the California Constitution.

As a legislative act, the listing of mountain lion as threatened under CESA takes away or voids the initiative statute's essential provisions for an expedited depredation approval process. Because such conduct would be in violation of article II, section 10, subdivision (c) of the California Constitution, we respectfully request that you deny the Petition.

Sincerely,

Pamela H. Silkwood

March 26, 2020

Eric Sklar, President
California Fish and Game Commission
1416 9th Street, Room 1320
Sacramento, CA 95814

Re: Request to delay consideration of mountain lion CESA petition

President Sklar and Commissioners:

The above-identified organizations represent farmers, ranchers, and other rural county residents who would be most significantly impacted by the Commission's decision whether listing of mountain lions in the Central Coast and Southern California as threatened under the California Endangered Species Act "may be warranted." Our organizations recognize that the current COVID-19 public health crisis has necessitated a shift from in-person hearings to remote policymaking, and we commend the Commission for taking diligent action to safeguard the health of its members, staff, and constituents. But while many of our Central Coast and Southern California members had earlier in the year expressed an eagerness to drive to Sacramento to appear in person at the Commission's hearing, we are concerned that shifting April's Commission hearing to a "Teleconference/Webinar" format will exclude those stakeholders from meaningful involvement in the policy process. We therefore respectfully request that the Commission delay its consideration of the mountain lion petition until its June 24-25 hearing.

The COVID-19 emergency has fundamentally and substantially altered the business and personal lives of all Californians. Many families are grappling with the closure of schools and day care facilities, educating and caring for their children while balancing a full work schedule. Many are adjusting to working from home full-time, and others to no longer working at all. Many are ill, whether with COVID-19 or with other maladies they fear could put them at added risk should they contract COVID-19. Given these enormous changes and concerns—and Californians' efforts to address and adapt to them—it may be difficult for many stakeholders to make time or otherwise arrange to meaningfully engage in the regulatory process at this time.

Additionally, many of your constituents who would be most significantly impacted by your finding as to whether listing "may be warranted" do not have reliable access to a webinar format. For instance, only 86.2% of San Luis Obispo County—which is fully within the ESU boundaries identified within the petition—is served by broadband internet. Many residents living in rural areas of San Luis Obispo County will not be able to access a Commission webinar, limiting their access to information provided by and to the Commission, including PowerPoint presentations, and limiting their ability to meaningfully participate in the hearing. In Kings County, which is within the ESU boundary west of I-5, broadband access is available in only 84% of the County. According to the Public Policy Institute of California, only 59% of rural households have broadband internet.

Moreover, the Governor's stay-at-home order precludes rural residents without broadband from making reasonable efforts to otherwise avail themselves of the webinar format. As a result of social distancing measures intended to "flatten the curve" of the COVID-19 crisis, rural residents cannot make use of their friends' or neighbors' electronic resources, nor can they use the resources of their local library, as most library branches have closed during the pandemic.

While the teleconference option would support greater participation than the webinar format, it remains problematic, as participation via teleconference would deprive participants of vital visual information presented in the hearing. Additionally, much of the rural landscape of the Central Coast and Southern California comprises cellular "dead zones" where residents lack reliable cellular reception to participate in a hearing via teleconference.

The Governor currently projects that the stay-at-home order could remain in effect for eight to twelve weeks. The Commission's June 24-25 hearing is outside of that twelve-week window, suggesting that it may be safe to proceed with an in-person public hearing at that time. Moreover, we note that the Commission's June hearing is scheduled to be held in Santa Ana, conveniently accessible to stakeholders on the Central Coast and in Southern California. Because the webinar/teleconference format would preclude the participation of impacted stakeholders, and because the June hearing would better facilitate the participation of those stakeholders, we respectfully request that the Commission delay its decision whether listing "may be warranted" until its June hearing.

Sincerely,

Kirk Wilbur
Vice President of Government Affairs
California Cattlemen's Association

Valerie Nera
Policy Advocate
California Chamber of Commerce

Sunshine Saldivar
Associate Counsel
California Farm Bureau Federation

Staci Heaton
Senior Regulatory Affairs Advocate
Rural Counties Representatives of California

From: Norm Groot <norm@montereycfb.com>
Sent: Tuesday, March 31, 2020 2:22 PM
To: FGC <FGC@fgc.ca.gov>
Subject: Comment Letter - Agenda Item #32

Attached please find comment letter from Monterey County Farm Bureau on Mountain Lion listing under CESA.

Thanks for your consideration.

Norm Groot
Executive Director,
Monterey County Farm Bureau
1140 Abbott St., Ste. C, Salinas CA 93901
Mail: P.O. Box 1440, Salinas CA 93902-1440
Office: 831-751-3100
norm@montereycfb.com
www.montereycfb.com

FARM BUREAU
MONTEREY

1140 Abbott Street, Suite C, Salinas, CA 93901 • PO BOX 1449, Salinas, CA 93902
office (831) 751-3100 • www.montereycfb.com

March 30, 2020

California Fish & Game Commission
Att: Eric Sklar, President
1416 – 9th St., Room 1320
Sacramento, CA 95814

VIA: E-mail to fgc@fgc.ca.gov

RE: Mountain Lion CESA Petition – Request for Delay

President Sklar and Fish & Game Commissioners:

Monterey County Farm Bureau represents family farmers and ranchers in the interest of protecting and promoting agriculture throughout our County. Since 1917, Farm Bureau strives to improve the ability of those engaged in production agriculture to provide a reliable supply of food and fiber through responsible stewardship of our local resources.

Farmers and ranchers in the Salinas Valley, and greater Monterey County, will experience significant impacts by the decision to list mountain lions in the Central Coast region as threatened under the CA Endangered Species Act (CESA).

We can all agree that the COVID-19 crisis is impacting all facets of life as we used to know it. This has caused many to shelter at home, yet farmers and ranchers are 'essential' and continue to grow their crops and manage their animals to keep the food supply moving forward. Nowhere is that more critical than here in the Salinas Valley, the "Salad Bowl of the World."

While accommodations may be made to hold meetings virtually, this is not conducive to the agricultural community who spends most of their time outdoors, away from their computer or tablet. And during this crisis, there is little bandwidth for anything other than the mission critical operations, such as making sure their fieldworkers are healthy and safe and using good protocols to maintain sanitary and social distancing mandates.

Thus, it will be difficult for the local agricultural community to participate and provide public feedback at the Commission's meeting on April 15th (Agenda item #32). This decision about mountain lions is of high interest to Farm Bureau's constituents, and consideration should be given to the 'regulated community' and the intense pressures they are currently under.

We ask that the Commission's June meeting be the focal point of this discussion about the listing of mountain lions under CESA, when farmers and ranchers will have better opportunity to participate more fully in the public policy process.

Please consider delaying the agenda items scheduled for April 15th to a later day.

Thanks for your consideration.

Sincerely,

Norman C. Groot
Executive Director

From: [redacted]
Sent: Monday, March 23, 2020 1:47 PM
To: FGC <FGC@fgc.ca.gov>
Subject: Protect California's Struggling Mountain Lions

Dear California Fish and Game Commission,

I'm writing to urge you to list Southern California and Central Coast mountain lions as "threatened" under the state's Endangered Species Act.

As you know these mountain lions face multiple threats to their survival. Over the past century, habitat loss and fragmentation have led to severe genetic isolation and inbreeding. These big cats are also victims of vehicle collisions, rat poisons and depredation kills, among other threats. Protections under the state's Endangered Species Act would help alleviate some of these threats by improving habitat connectivity between isolated populations and preserving natural wildlife corridors vital to the survival of these populations.

We're in the middle of an extinction crisis, and we simply can't afford to wait to protect keystone species like the mountain lion. As the last remaining large carnivore in Southern California and the Central Coast, mountain lions are vital to maintaining biodiversity. The presence of this wide-ranging top predator has been shown to help maintain diverse habitats that support a multitude of fish, amphibian, reptile, bird, mammal, insect, and invertebrate species. And many scavengers, like California condors and numerous insects, that feed on mountain lion prey would lose a reliable food source. Loss of the species could potentially lead to degraded ecosystems and decreased biodiversity.

I strongly urge the California Fish and Game Commission to accept the California Department of Fish and Wildlife's recommendation that listing may be warranted and advance Southern California and Central Coast mountain lions to candidacy.

Please move forward quickly to protect these struggling mountain lion populations knowing you have my full support.

Sincerely,
Lisa Levinson
Topanga, CA 90290
[redacted]

CESA Petition Evaluation: Mountain Lion (*Puma concolor*)

Photo Credit: Donna Krucki

Fish and Game Commission - April 16, 2020

Esther Burkett – Wildlife Branch/Nongame Wildlife Program

Presentation Outline

- Conservation Status
- Species Overview
- Petition Evaluation Process
- Petition Evaluation
- Department Recommendation

Conservation Status

Former Range of Mountain Lions in North America and Legal Status in California

From Culver et al. 2000, cited in the Petition.

<u>California Status:</u>

Many changes in legal status over time, including a bountied predator, nongame mammal, and a game mammal

"Specially Protected Mammal" in 1990 (FGC Section 4800)

Public Safety, Depredation, Educational, and Scientific Research Take Exceptions

Species Overview: Distribution and Taxonomy in California

- **Order: Carnivora**
- **Family: Felidae**
- **Formerly *Felis concolor*, with two subspecies in California**

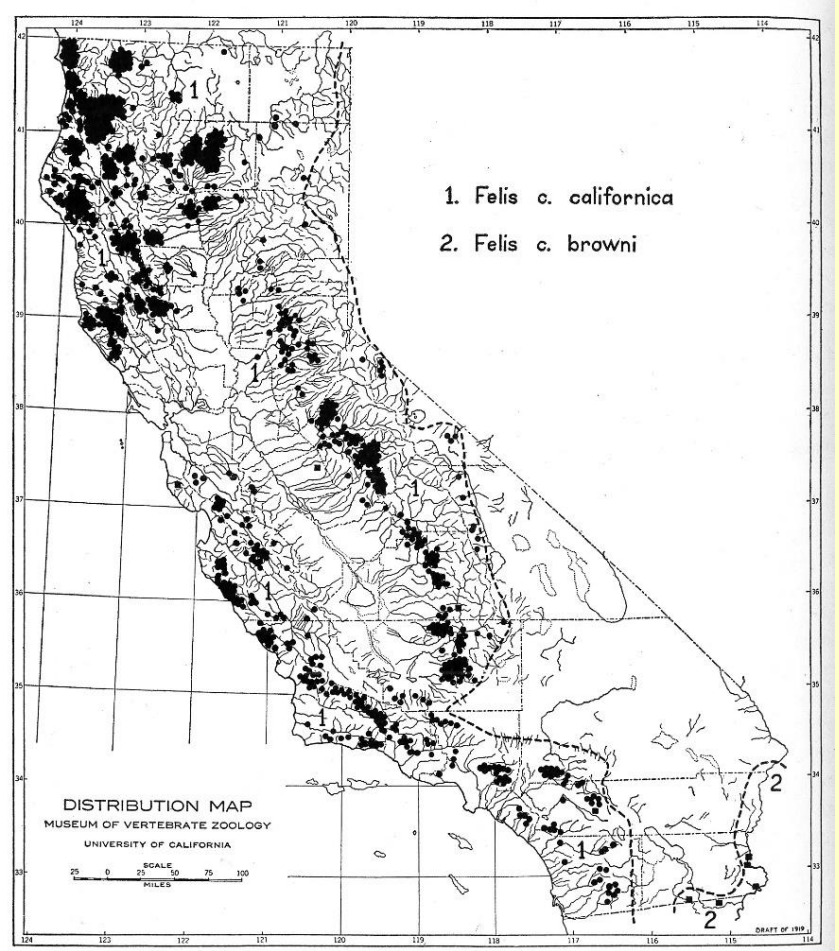
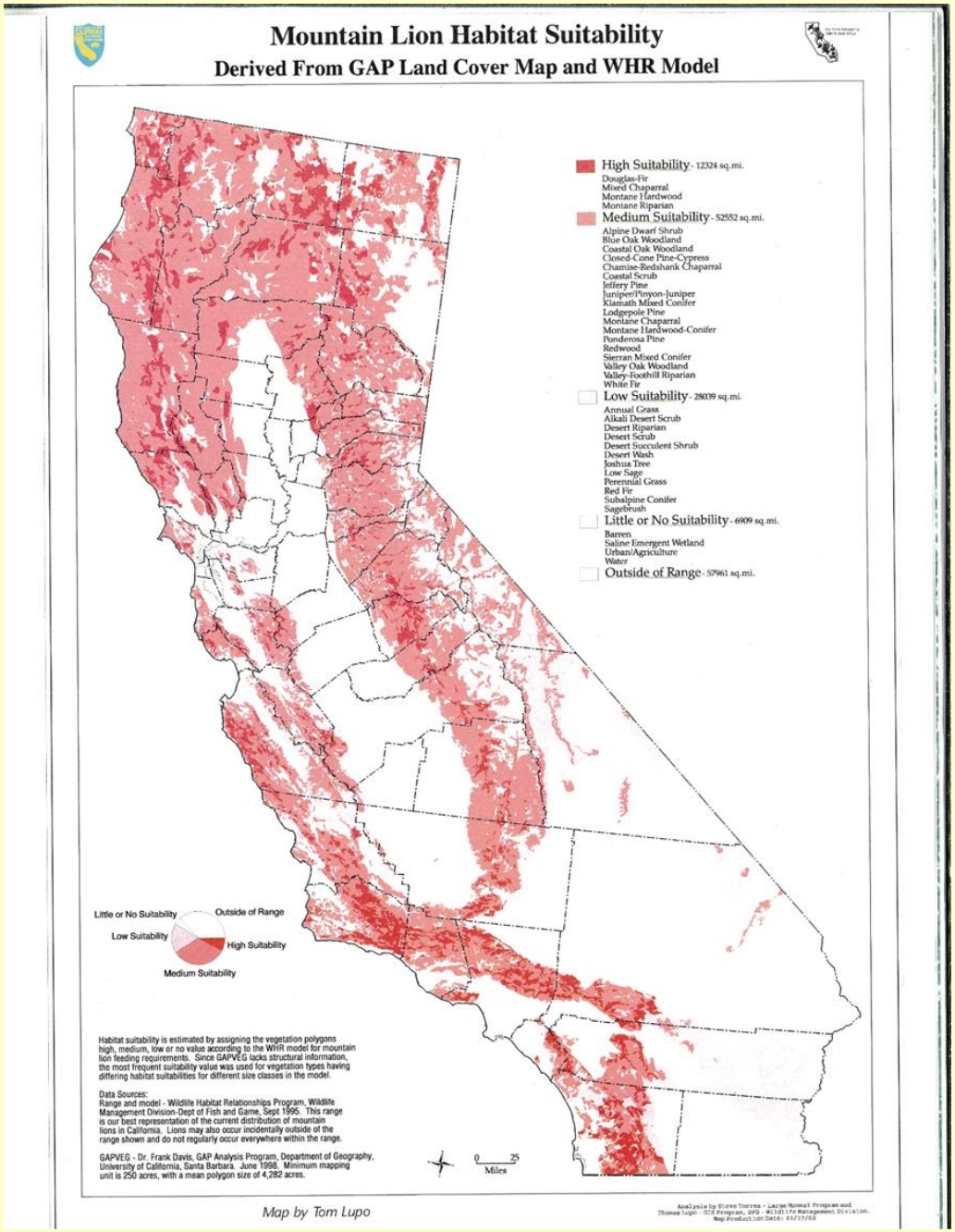


Fig. 221. Distribution of mountain lions in California: Round spots indicate localities of capture as stated in the Fish and Game Commission bounty records for the 7-year period, 1913–1919; square spots indicate some known localities of record otherwise, most of them as represented by specimens preserved. The approximate former limits, in California, of the two races are shown by broken lines; these races are: *1*, California mountain lion; *2*, Yuma mountain lion.

Species Overview:

Mountain Lion Range and Habitat Suitability in California



Species Overview: Life History

Apex predator, occurs in low densities

Territorial and mostly solitary

Females care for their young for 1-2 years

Deer are the primary prey species

Juvenile males disperse further than females

Photo Credit: Wildlife Health Center, UC Davis

Petition Evaluation Process

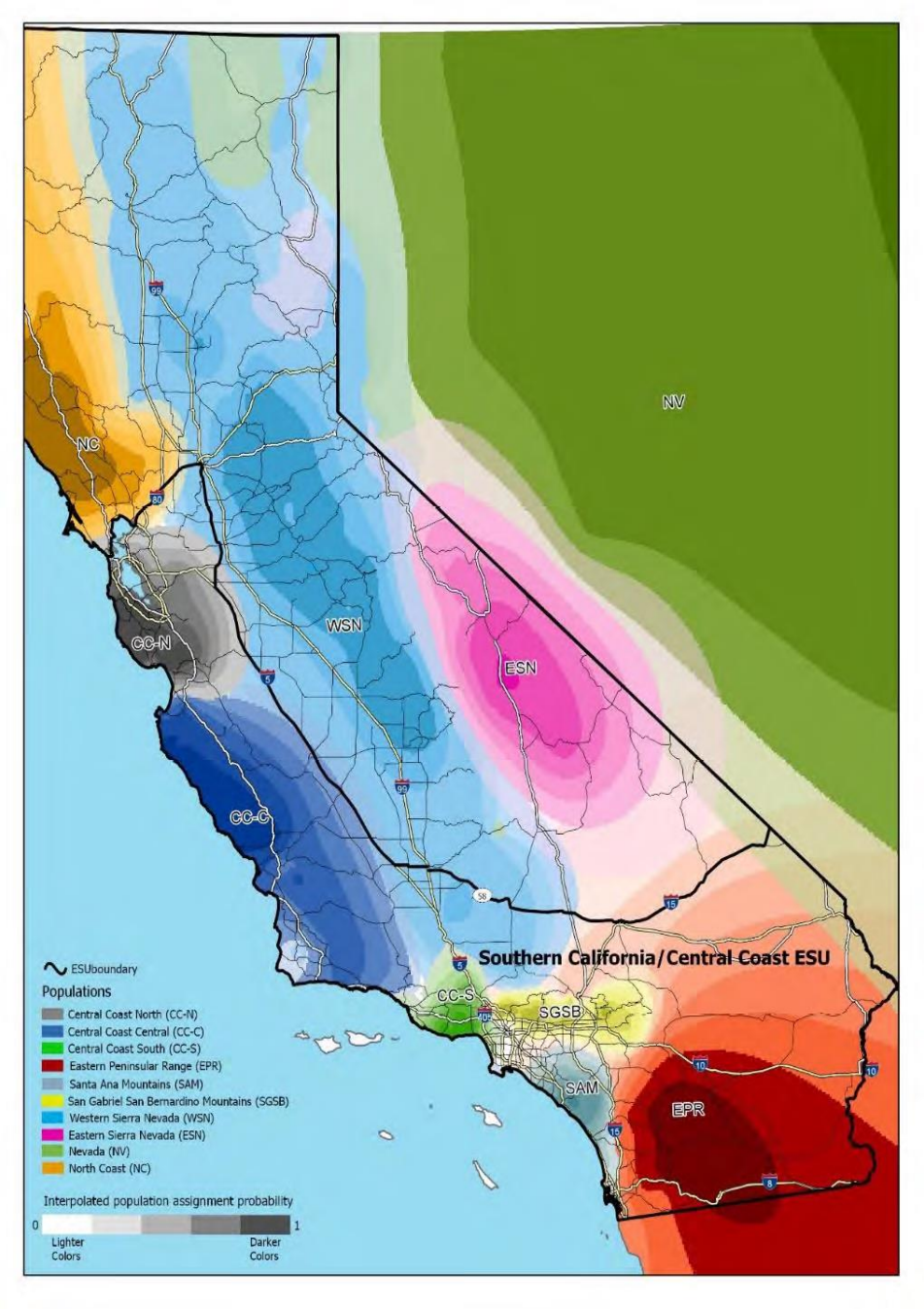
1. Population trend
2. Range
3. Distribution
4. Abundance
5. Life history
6. Habitat
7. Survival and reproduction factors
8. Degree/immediacy of threat
9. Impacts of existing management
10. Suggestions for future management
11. Information sources
12. Detailed distribution map

Petition Evaluation

Proposed Southern California/Central Coast ESU

Six Genetic Subpopulations of Mountain Lions

- Central Coast North (CC-N)
- Central Coast Central (CC-C)
- Central Coast South (CC-S)
- San Gabriel/San Bernardino Mtns (SGSB)
- Santa Ana Mtns (SAM)
- E. Peninsular Range (EPR)



Petition Evaluation: Population Trend and Abundance

Population	Effective Population Size (N_e)	Estimated Total (Adult) Population (N)
Central Coast North (CC-N)	16.6	33-66
Central Coast Central (CC-C)	56.6	113-226
Central Coast South (CC-S)	2.7[2]	5-10
Santa Ana Mountains (SAM)	15.6[3]	31-62
San Gabriel/ San Bernardino Mountains (SGSB)	5	10-20
Eastern Peninsular Range (EPR)	31.6	63-126
Total		255-510

Petition Evaluation: Factors Affecting the Ability of the Population to Survive and Reproduce

- Lack of habitat connectivity
- Habitat loss and fragmentation
- Low genetic diversity/inbreeding depression
- Anthropogenic mortality factors
- Intraspecific strife (i.e., aggression between lions)
- More frequent wildfires
- Climate change

Photo Credit: Wildlife Health Center, UC Davis

Petition Evaluation: Degree and Immediacy of Threats

- Human population growth
- Continued habitat loss and fragmentation
- Further degradation and destruction of habitat connectivity
- Need for wildlife crossing infrastructure
- Need for preservation of intact linkages, e.g., Tehachapi and Sierra Pelona Mountains

Photo Credit: Wildlife Health Center, UC Davis

Petition Evaluation: Kind of Habitat Needed for Survival

- Large, contiguous blocks of habitat
- Adequate movement corridors
- Sufficient cover
- Wide variety of prey, especially large ungulates

Photo Credit: Wildlife Health Center, UC Davis

Petition Evaluation: Impact of Existing Management Efforts

- **California Environmental Quality Act**
  - Transportation infrastructure
  - Development projects
- **Southern California Natural Community Conservation Plans**

Photo Credit: Wildlife Health Center, UC Davis

Department Recommendation

- The Department concludes the Petition meets the requirement in Fish and Game Code section 2072.3 that it include sufficient scientific information to indicate the petitioned action may be warranted.

- The Department recommends the Commission accept the Petition for further consideration under CESA.

Questions ◈ Thank You

Esther Burkett
Senior Environmental Scientist
916-531-1594
Esther.Burkett@wildlife.ca.gov

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