

State of California  
Natural Resources Agency  
Department of Fish and Game

**REPORT TO THE FISH AND GAME COMMISSION**

**A STATUS REVIEW OF THE FISHER (*Martes pennanti*)  
IN CALIFORNIA**

February 2010



Photo by Rebecca Green, USFS

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### List of Acronyms and Abbreviations

ATV	All Terrain Vehicle
BLM	Bureau of Land Management
Board	Board of Forestry and Fire Protection
CAL FIRE	California Department of Forestry and Fire Protection
Caltrans	California Department of Transportation
CBD	Center for Biological Diversity
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CCAA	Candidate Conservation Agreement with Assurances
CDFG	California Department of Fish and Game
CDV	Canine Distemper Virus
CI	Confidence Interval
CNDDDB	California Natural Diversity Database
Commission	Fish and Game Commission
CPV	Canine Parvovirus
CWHR	California Wildlife Habitat Relationships
DBH	Diameter at Breast Height
Department	California Department of Fish and Game
ESA	Federal Endangered Species Act
FEIS	Final Environmental Impact Statement
FGC	Fish and Game Code
FIA	Forest Inventory Analysis
FPA	Forest Practice Act
FPR	Forest Practice Rules
FRI	Fire Return Interval
GD	Green Diamond Resource Company
HCP	Habitat Conservation Plan
HRC	Humboldt Redwood Company
LSR	Late Successional Reserve
MIS	Management Indicator Species
MRC	Mendocino Redwood Company

NCCP	Natural Community Conservation Plan
NPS	National Park Service
NSO	Northern Spotted Owl
NWFP	Northwest Forest Plan
ORV	Off Road Vehicle
PL	Pacific Lumber Company (now Humboldt Redwood Co.)
PSU	Primary Sampling Unit
ROD	Record of Decision
Service	U.S. Fish and Wildlife Service
SEIS	Supplemental Environmental Impact Statement
SKCNP	Sequoia-King's Canyon National Park
SNAMP	Sierra Nevada Adaptive Management Project
SNFPA	Sierra Nevada Forest Plan Amendment
SPI	Sierra Pacific Industries
THP	Timber Harvest Plan
TPZ	Timber Production Zone
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFS	United States Forest Service
WLPZ	Watercourse and Lake Protection Zones
YNP	Yosemite National Park

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Habitat characteristics of fisher den and rest sites and home range size.

**Front cover photograph:** Fisher kit at den in incense cedar snag, photo by Rebecca Green, U.S. Forest Service, Kings River Fisher Project.

## **EXECUTIVE SUMMARY**

This document describes the current status of the fisher (*Martes pennanti*) in California as informed by the scientific information available to the Department of Fish and Game (Department).

The Department recommends to the Fish and Game Commission that designation of the fisher in California as threatened/endangered is not warranted.

### **Background**

The Center for Biological Diversity submitted a petition on January 23, 2008, seeking action by the California Fish and Game Commission (Commission) to list the fisher as threatened or endangered under the California Endangered Species Act. Pursuant to Fish and Game Code (FGC) section 2073, the Commission referred the petition to the Department of Fish and Game (Department) for its evaluation and recommendation.

The petition recommended listing of the fisher as threatened or endangered in California primarily because of petitioner's conclusion that long-term forest management and timber harvest activities have reduced the acreage of late successional forests that tend to have the bulk of the structural elements (high canopy cover and mature/old trees) that fisher use for denning and resting; that logging and other factors have caused and are causing a decline in fisher range; and that the population in California is small, isolated, and declining or at risk of decline because of these effects. The petition also reviewed timber harvest regulatory mechanisms, and other identified factors.

The Department found that the information in the petition was insufficient to indicate the petitioned action may be warranted, and recommended the Commission reject the petition (CDFG 2008). At the August 7, 2008 Commission meeting regarding the fisher petition, the Commission discussed the Department's evaluation report, recommendation, and public testimony, and voted to reject the petition. On March 4, 2009, the Commission reconsidered and voted to accept the petition to list the fisher as an endangered or threatened



species. A Notice of Findings was published in the California Regulatory Notice Register on April 24, 2009, designating the fisher a candidate species, thereby starting the candidacy period and the one year status review process. A candidate species is defined as a native species or subspecies of bird, mammal, fish, amphibian, reptile, or plant the Commission has formally noticed as being under review by the Department for addition to either the list of endangered species or the list of threatened species. The Commission also adopted a special order pursuant to FGC Section 2084 to provide for incidental take of fisher under specific circumstances during the candidacy period.

This report, pursuant to FGC Section 2074.6, details the Department's review and recommendations to the Commission regarding the proposed listing of the fisher as a threatened or endangered species under CESA. The review is based on the best scientific information available and preliminarily identifies habitats that may be essential to the continued existence of the species. The review also suggests some management activities and other recommendations that could contribute to recovery of the species.

## **Findings**

*Information gained since the Department's Petition Evaluation.* - Since the petition evaluation, there have been some changes in knowledge about the fisher in California, although most of these are preliminary findings as the work is not complete and results have not been published. The Department recommends that decision-making not be based on such preliminary scientific information. First, recent genetic analysis is preliminarily indicating that the two populations of fisher may have been separated in time and space for thousands of years. This would bring in to question whether there were fisher present continuously throughout the Sierra Nevada. The Department has located written information on a few additional records since the petition evaluation illustrating at least some level of fisher presence in portions of the central Sierra Nevada historically, but believes the question will never be fully resolved. Secondly, increased surveillance for disease and other mortality factors is occurring, especially in the southern Sierra Nevada, where there is concern about the overall low population size and the apparent inability of the population to expand their range northward into the central Sierra Nevada. Barriers to movement include highway mortality

in and around the Yosemite National Park area. The significance of these mortality factors on the population or in limiting the dispersal of the population are not yet known.

*Life History.*- The fisher is one of the larger members of the weasel family (*Mustelidae*) and a forest carnivore that inhabits conifer, mixed-conifer, and hardwood tree habitats that are interspersed with associated habitats and forest openings represented by herbaceous plant communities, riparian areas, and shrubfields. Concerning the life requisites of breeding, cover, and feeding, the fisher is regarded as needing large, old trees, snags, or down logs with small cavities for denning and resting in stands that have high canopy closure; and preys on small mammals in the forest understory or in adjacent openings.

*Range and Distribution.*- Fisher distribution in California today is represented by two populations, the northern California population that ranges over 10 million acres, and the smaller area southern Sierra Nevada population (approx. 2.6 million acres of range). Fisher apparently no longer inhabit Marin, Sonoma, and most of Mendocino County, or generally between the Pit River in the northern Sierra Nevada/Cascades to the Merced River in the southern Sierra Nevada. These two populations are separated by approximately 270 miles (430 km). There is little empirical evidence of fisher previously inhabiting this gap in the Sierra Nevada range, although the Department believes they did at some level, and we are largely relying on observation data and on trapping reports and distribution accounts described by Grinnell et al. (1937). Thus, as much as 43 percent of historical range is either: 1) not inhabited by fisher now; 2) not part of historical range; or 3) fisher are extremely rare in this area. In this geographic area, there have been a handful of reported observations since the early 1900's. Overall, the Department concludes that there has not been substantial change in fisher population distribution since the Grinnell period of the 1920's, and that natural recolonization of fisher to former range in any detectable number has not occurred.

The range declines that are recognized are best explained by exploitative trapping in the early decades of the 1900's (or earlier); with recolonization success hypothesized by some to be hindered by habitat modification from timber harvesting, other human-caused factors, and limited dispersal capability of

fisher. Understanding of the current reasons for the Sierra Nevada “gap” in fisher distribution may soon be confounded by the preliminary genetic analysis indicating separation of the northern and southern populations for thousands of years. This would suggest that some portion of this range was not continuously inhabited by fisher. With or without the new genetic information, it is doubtful the true historical distribution of fisher in the gap area can accurately be determined; densities or population estimates from that period certainly cannot be determined.

*Population and Trend.*- The estimates of fisher population numbers in California remain the same as in the petition evaluation. These estimates are fewer than 500 animals in the southern Sierra Nevada, and from 1,000-4,000 in northern California. Trend information at the population level is not available for northern California, although the specific Hoopa fisher numbers cited in the petition evaluation have now been reported as being fairly stable to slightly upward since 2006. In the southern Sierra Nevada, preliminary estimates on the long-term monitoring effort suggest that population has remained stable since 2002-03.

## **Threats**

Potential threats to the fisher population include timber harvest that excessively reduces late seral forest and/or does not retain late seral habitat elements, catastrophic fire, and the small population estimate in the southern Sierra Nevada. These threats are considered the more relevant potential threats at this time, although in fact, we lack specific empirical evidence that they are limiting the fisher populations in the state. Timber harvest is more widespread in the northern California population, while fire risk and the small population size are more relevant to the southern Sierra Nevada population. Additionally, with new preliminary information obtained, disease could possibly be a threat although uncertainty remains. Other potential threats identified (roads, predation, climate change, poaching/incidental capture, recreation, and urban development) are considered secondary as our understanding of their possible implications or significance would be more speculative.

## Current Management

Timber harvesting activities continue in fisher habitat, more so in northern California than in the southern Sierra Nevada. The Department has indicated that the state's Forest Practice Rules (FPRs) lack specific protections for the fisher and that current silvicultural practices can reduce fisher habitat suitability. However, information submitted during the review indicated fisher use industrial timberlands to meet all or some of their life requisites. The degree to which current FPRs and timber management of the landscape affects fisher habitat suitability and the fisher population remains unknown in the absence of both fisher population monitoring and sufficient compliance monitoring of the FPRs. Lack of retention of late successional stands could reduce local habitat suitability and the cumulative effect could reduce suitability over large areas; however, lacking sufficient monitoring of the fisher population, there is no evidence in the petition or information assessed for this evaluation that current practices have reduced, or will imminently reduce, long-term population viability.

As it relates to management of private timberlands, implementation of the regulations does not mean *per se* that private timberlands will be managed such that they chronically reduce habitat suitability for fishers. Harvest history, market conditions, site productivity, company philosophy as well as other factors, including appropriate and consistent application of CEQA, also influence how private timberlands are managed and their suitability for fishers. Additionally, protections for old forest components and potential fisher habitat on private lands are in a better state than in decades past as a result of environmental regulation.

In the southern Sierra Nevada, there are two major studies underway on fisher to assess fisher response to anticipated US Forest Service land management activities such as timber harvest and fuel reduction. Combined, these studies have maintained 50-60 individual fisher as telemetered study animals. Information on distribution, mortality factors, genetics, movements, and habitat use are being obtained from these efforts. A population level monitoring strategy for the area is also underway to help develop a better understanding of the status and trend in fisher numbers.

In northern California, individual study projects are still underway on various ownerships. A translocation effort, moving 15 fisher into the northern Sierra Nevada, has been initiated. The project plans to move 40 fisher total (over three years) from other northern California locations to the area in a several year project and study to evaluate success of the effort.

## **Conclusions**

The fisher in California occurs as two populations, one in northwestern California forests where its range is estimated at 8-12 million acres; and the other population in the southern Sierra Nevada where its range is estimated at 2-3 million acres. These values represent total acres of range and do not reflect the actual acreage of suitable and optimal habitat.

The Department, in collaboration with USFWS and SPI initiated a multi-year translocation project to move fisher to historical range in the northern Sierra Nevada. Fifteen fisher were released on SPI lands between December 2009 and February 2010. These animals are not considered as part of the fisher population in this status review. The intent is to release 40 animals total in three consecutive years and intensively track and monitor their movements, habitat use, and survival. While it is hoped they will establish as a self-sustaining and ultimately expanding population, it will be several years before success/failure will be determined.

The fisher is considered absent from or extremely rare in up to 43 percent of historical range encompassing the coast redwood area of California from Marin County to southern Humboldt County, and in the southern Cascades and the northern and central Sierra Nevada, generally from the Pit River in the north to the Merced River in the south (essentially the northern and central Sierra Nevada). However, preliminary genetic analyses indicates that the two populations have been separated for “thousands of years” suggesting there has long been a gap in occurrence of fisher in the Sierra Nevada. It is doubtful the location or scale of such a discontinuous distribution can be determined if it did, in fact, exist. If such a gap occurred, then the percentage of historical range no longer inhabited would be somewhat less than the 43 percent estimate. Finally, the genetic differences recently detected do have possible implications for future

conservation/management activities such as translocation.

The historical record of fisher distribution and abundance in California is based on limited information, primarily from trapping related records. That information indicated the fisher inhabited the central and northern Sierra Nevada and that it was noticeably rare in the 1910s-1920s believed due to trapping. It is unknown what its abundance was before that time, such as during the gold rush era and settlement period in the state. Additionally, there is very little information collected on the fisher population or distribution between the 1920s and 1980s.

Since the 1980s, many investigations into fisher habitat use, selection, home range size, and preferences have been conducted; as have surveys and monitoring to assess distribution. There have been some limited study of food and foraging habits, and far more work on denning and resting habitat characteristics. More recently, investigation of genetic variability and disease have been occurring, as have modeling efforts to predict fisher viability into the future as it relates to factors such as climate change and wildfire risk. The science on fisher is increasingly broadening to large-scale, longer-term investigations rather than localized (site specific study) short-term study. From this, more population level inferences should be possible in the future.

In general, the studies indicate fisher prefer late seral forest habitat and require some of the habitat attributes or elements of late seral forests such as high canopy cover, large diameter trees, large snags, and large down logs for denning and resting habitat. Individual fisher may occupy and use multiple of these elements within their large home ranges. Studies also indicate that fisher inhabit managed forest on industrial timberlands wherein late seral habitat attributes exist or are left intact post-harvest, even though the stand may not be classified as late seral. While these stands may or may not be optimal habitat for fisher, it appears that in many of the reported cases that they are, at a minimum, suitable habitat for fisher. It is hypothesized that fisher population densities will be lower in intensively managed forests than in late seral forests. Foraging habitats include the understory of late successional forests as well as openings/patches that support understory vegetation and prey species in proximity to high canopy cover stands. Such habitats as described above can be considered the Department's preliminary assessment of essential habitats and habitat elements

for the fisher.

The available scientific information either separate or combined has not determined the limiting factors for the fisher populations in California. At the present time, we do not know whether they presently (several years) or in the recent past (several decades) they are increasing or decreasing. The current preliminary information in the Hoopa region and in the southern Sierra Nevada suggests they are stable to slightly increasing. The contention that intensive timber harvesting has eliminated habitat and therefore the fisher population is limited or is in decline, is a relationship that is not as linear as perceived. Reduction in late seral forest and fisher-preferred habitat elements has occurred in California, however for that to be limiting it must be assumed that the population was at carrying capacity such that they would be limited by harvest of such habitat features.

With recent preliminary genetic analyses, it is possible that the fisher did not continuously inhabit the Sierra Nevada from north to south. The Department is doubtful that the location, area, or extent of such a potential natural gap could be determined; although there are several anecdotal observations and trapping records that indicate fisher did inhabit areas of the central and northern Sierra Nevada in decades past.

Fisher populations at both the north and south ends of the state have not been adequately studied to conclusively determine whether they are declining or increasing, or expanding naturally back into (or retracting from) the Sierra Nevada or into other historical ranges in northern California. Study of the population trend is underway in the southern Sierra Nevada and preliminarily, it appears they have been stable in number over the past several years. It does not appear they are expanding their range, at least not in the approximate twenty year time frame in which they have become a more frequently studied species; and there is no evidence they have expanded north of the Merced River in the Sierra Nevada.

The southern Sierra Nevada population is considered low and has been model-estimated at fewer than 500 individuals, although it is unknown what the capacity for increase in fisher numbers is in the area; or what the population level should

be to be considered “high”. What seems more relevant is that the population may be limited by space as its only route or link for expansion is north up along the central Sierra Nevada. Predictive models of extinction risk suggest the population is at risk, yet it has been a sustaining (or recovering) population compared to elsewhere in the Sierra Nevada since the intensive trapping era of the past. The fisher has likely benefited from the presence of the two national parks historically, although the large number of travelers visiting Yosemite annually now, may be a detrimental factor in terms of road kill and dispersal concerns. Knowledge of fisher abundance in the national parks is largely unknown.

Natural recolonization could be influenced by the low reproductive potential of the species and by land use changes that have occurred since the populations were apparently reduced in the early 1900s.

The interaction of the above factors, and the possibility that combined effects result in cumulative impacts could influence natural recolonization of former range by fisher. Additionally, long-term conservation and range expansion of the southern Sierra Nevada fisher population may be dependent on the larger northern California population if there are not adequate numbers of Sierra Nevada animals to accomplish expansion on their own or through translocation.

### **Petitioned Action**

The Department recommends that designation of the fisher in California as threatened/endangered is not warranted.

### **Management and Recovery Recommendations**

The Department provides several actions described herein that it believes would have population-level benefits for fisher and their habitat.



## **Introduction**

### **Petition History**

The Center for Biological Diversity (CBD) submitted a petition on January 23, 2008, seeking action by the Fish and Game Commission (Commission) to list the Pacific fisher (*Martes pennanti*) as an endangered or threatened species under the California Endangered Species Act ("CESA"; Fish and Game Code (FGC) § 2050-2116). Pursuant to § 2073 of the FGC, on January 31, 2008, the Commission transmitted the petition (CBD 2008) to the Department of Fish and Game (Department) for review.

The Department had a 90-day period to review the petition and make one of the two following findings:

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

The Department requested a 30-day extension to complete the evaluation and was granted that request. The Department found that the information in the petition was insufficient to indicate the petitioned action may be warranted, and recommended the Commission reject the petition (CDFG 2008). At the August 7, 2008 Commission meeting regarding the fisher petition, the Commission discussed the Department's evaluation report, recommendation, and public testimony, and voted to reject the petition.

On March 4, 2009, the Commission voided and set aside its August 7, 2008 decision rejecting the petition, and voted to accept the petition to list the fisher as an endangered or threatened species. A Notice of Findings was published in the California Regulatory Notice Register on April 24, 2009, designating the fisher a candidate species, thereby starting the candidacy period and the one year status

review process. A candidate species is defined as a native species or subspecies of bird, mammal, fish, amphibian, reptile, or plant the Commission has formally noticed as being under review by the Department for addition to either the list of endangered species or the list of threatened species. The Commission also adopted a special order pursuant to FGC Section 2084 to provide for incidental take of fisher under specific circumstances during the candidacy period. The Department's status review of fisher in California is due to the Commission no later than April 23, 2010.

### **Department Review**

This report, pursuant to FGC Section 2074.6, provides the Department's review and recommendations to the Commission regarding the proposed listing of the fisher as a threatened or endangered species under CESA. The discussion and analysis set forth below is based on the best scientific information available. Further, this status review preliminarily identifies habitats that may be essential to the continued existence of the species and suggests management activities and other recommendations for recovery of the species.

The Department contacted affected and interested parties, invited comment on the petition, and requested scientific information that may be available, as required under FGC Section 2074.4. The Department mailed a public notice and solicitation of information on June 26, 2009, to affected and interested parties (Appendix A). The Department also posted a 30-day public notice on its website on September 2, 2009, and produced a news release on September 3, 2009 to solicit information (Appendix A).

In the effort to obtain and review the available information on fisher in California, Department staff contacted scientists, agency personnel, landowners, researchers and others for information. Information provided to the Department by the scientific community and knowledgeable parties is vital to the completeness of this review. In addition, the Department provided a draft version of this status review to several qualified experts for peer review. The list of scientific experts and their peer review comments to the Department regarding the status review are contained in Appendix B. The Department considered all of the peer review comments received in the preparation of this report.

The Commission and Department received 16 comment letters during the public notice periods (Appendix C). Thirty-eight percent opposed listing, 38% percent supported listing, and 25% did not state support or opposition.

### **Fisher as a Species of Special Concern and a Federal Candidate for Listing**

In 1986, the fisher was included in the Species of Special Concern (SSC) list (Williams 1986), and the species account noted: “Attention should focus on the Sierra Nevada, as evidence suggests declining populations there (Schempf and White 1977)”. The account also included the following: “Effects of various forest harvesting practices on fisher populations should be determined over a broader area”....and “Snags, damaged and senescent trees with large cavities, and hollow logs are probably important for fishers, especially where talus and rock crevices are unavailable”.

The Department considers taxa on the SSC list to be among those of greatest conservation need. The species on this list were used in the development of California’s Wildlife Action Plan (CDFG 2007). The wildlife action plan report reviewed wildlife species of concern in each bioregion of the state to identify conservation challenges, and develop a strategy or framework that will highlight stewardship activities necessary to halt species’ declines and to maintain species diversity. The fisher is one of several species selected to illustrate conservation issues within the Sierra Nevada and Cascade bioregion. Portions of the account from this report are as follows: “...the status of the Pacific Fisher is one indicator of the status of forest conditions of the Sierra, particularly the old-growth component. The fisher requires specific features of mature forest, such as large trees with cavities...”, and “Conservation of the Pacific Fisher is dependent upon the approaches to and success of restoring healthy and diverse forest ecosystems along the Sierra range” (CDFG 2007:301).

In 2004, the U.S. Fish and Wildlife Service (Service) issued a 12-month finding on a petition for listing the fisher under the federal Endangered Species Act (ESA) (USDI 2004). The Service determined that the petitioned action was warranted, but precluded by higher priority actions to amend the Lists of Endangered and Threatened Wildlife and Plants. The fisher is currently designated a candidate species under ESA.

## Life History

### **Species Description**

The fisher is a member of the order Carnivora, family Mustelidae. The mustelid family includes martens, weasels, mink, and otters. Fishers have a slender weasel-like body with relatively short legs and a long well-furred tail (Douglas and Strickland 1999). Fishers appear uniformly black from a distance, but in fact are dark brown over most of their bodies with white or cream patches distributed on their undersurfaces (Powell 1993:3). The fur on the head and shoulder may be grizzled with gold or silver, especially in males (Douglas and Strickland 1999). The fisher's face is characterized by a sharp muzzle with small rounded ears (Grinnell et al. 1937), and forward facing eyes indicating well developed binocular vision (Powell 1993:3). Sexual dimorphism in body size is pronounced, with females weighing between 2.0-2.5 kg (4.4-5.5 lbs) and ranging in length from 70-95 cm, and males weighing between 3.5-5.5 kg (7.7-12.1 lbs) and ranging from 90-120 cm long (Powell 1993:3-4).

Fishers are commonly confused with the smaller American marten (*M. americana*), which is lighter in color (cinnamon to milk chocolate), has an irregular cream to bright amber throat patch, and has more pointed ears and a proportionately shorter tail (Lewis and Stinson 1998). Fishers have a single molt in late summer and early fall, and shedding starts in late spring (Powell 1993). The molting of hair on the tail can be extensive, giving the appearance of a "rat-tail" in some individuals.

Fishers are seldom seen, even where they are abundant. Although the arboreal ability of fishers is often emphasized, most hunting takes place on the ground (Coulter and Powell in Douglas and Strickland 1999). Females, perhaps because of their smaller body size, are more arboreal than males (Powell, and Pittaway in Douglas and Strickland 1999).

## Taxonomy

The fisher (*Martes pennanti*) is one of the larger members of the weasel family (Mustelidae), belonging to the subfamily Mustelinae, and genus *Martes*. The fisher is the only extant member of the subgenus *Pekania* and the largest member of the genus *Martes* (Anderson 1994). Goldman (1935) found evidence of three subspecies: *Martes pennanti pennanti* (eastern and central North America), *M. pennanti columbiana* (Rocky Mountains), and *M. pennanti pacifica* (West Coast of North America). However, Grinnell et al. (1937) found no evidence of subspecies differentiation after examining morphology and pelage characteristics of fisher from Maine, Quebec, Washington, and California. Hagmeier, in Douglas and Strickland (1999), also concluded the subspecies could not be separated on the basis of pelage or skull characteristics. Thus, for the purposes of this report as part of the listing petition process, and until new scientific information is provided, we use *Martes pennanti* as the taxonomic designation for native fishers found in California historically, and at this time.

## Genetics

Recent genetic studies and review papers have shown evidence of population subdivision in fishers, especially among populations in the western U.S. and Canada (Drew et al. 2003, Aubry and Lewis 2003, Wisely et al. 2004). In California, the northern fisher population differs strongly in haplotype frequencies from the southern Sierra population, and from fisher populations elsewhere (Drew et al. 2003, M. Schwartz, August 21, 2009 letter in Appendix C). Wisely et al. (2004) found evidence that genetic diversity followed a latitudinal gradient, decreasing from the northern extent of fisher range in British Columbia to the southern region of the Sierra Nevada Mountains in California. The pattern of decreasing genetic diversity with decreasing latitude holds true for measures of heterozygosity, allelic richness, number of unique alleles, and effective population size within the Pacific coast distributional peninsula from British Columbia to the southern Sierra Nevada (Wisely et al. 2004).

When compared to the continental core of fisher range (Kyle et al. 2001), genetic diversity measures are lower in the Pacific coast region (Wisely et al. 2004). Heterozygosity estimates in the Pacific coast periphery region were less than half

of those within the continental core (Wisely et al. 2004).

Genetic study in the eastern Klamath province of northern California indicated that fishers there are native to northern California and are not similar to haplotypes found in introduced fisher in southern Oregon from the early 1980s (S. Farber, August 14, 2009 letter in Appendix C; S. Farber, Pers. Comm. January 2010). Thus, translocated fishers (from Minnesota and British Columbia) in southern Oregon have not expanded their range into California (Aubry and Lewis 2003). The authors believe this suggests that suitable habitat in surrounding areas may be inadequate to support fishers.

A substantial amount of genetic analysis of California's fisher populations is ongoing in 2009-10. As of this report, there are some interesting preliminary results that would have implications for conservation and management, but the Department is reluctant to consider these as facts until the studies are complete. To fully inform the Commission, the cases are mentioned in the following two paragraphs.

Reported levels of genetic structure within the Pacific Coast region are very high (Aubry and Lewis 2003, Drew et al. 2003), among the highest reported for a mammalian carnivore (Wisely et al. 2004). An example of this structure may be reflected in the fisher population in the southern Sierra Nevada. There, fisher are separated by the Kings River within <100 km of contiguous forest, yet exchange on average only one migrant every 50 generations (Wisely et al. 2004). However, there is uncertainty regarding these differences, as a current study is investigating the connectivity of the populations separated by the Kings River, and preliminary analyses show higher genetic exchange rates than found by Wisely et al. (2004), based on a higher number of samples (J. Tucker, August 21, 2009 letter in Appendix C).

Another study has preliminarily reported to the Department that genetic analyses suggests the two fisher populations in California (northern California and southern Sierra Nevada) have been separated for thousands of years (M. Schwartz, August 21, 2009 letter in Appendix C). These preliminary reports, if validated, would have implications to the understanding of historical fisher distribution in the Sierra Nevada because such genetic differences would indicate

a discontinuous range between the population (an apparent “gap” in occupied range) may have naturally occurred somewhere in the Sierra Nevada. (This topic will be further evaluated in the Department’s review of historical range and occurrences of the fisher.)

## **Food Habits**

Fishers are opportunistic, generalist predators with a diverse diet including mammalian and avian prey, ungulate carrion, vegetation, insects, and fungi (Grenfell and Fassenfest 1979, Powell 1993, Martin 1994). Throughout their continental range, reported prey items include: porcupines (*Erethizon dorsatum*), snowshoe hares (*Lepus americana*) squirrels (Sciuridae), mice and voles (Muridae), moles and shrews (Talpidae and Soricidae), carrion of deer and moose (*Odocoileus* sp. and *Alces alces*), other carnivores such as grey fox (*Urocyon cinereoargenteus*), skunks (Mephitinae) and raccoons (*Procyon lotor*), bats (*Myotis* sp), reptiles (Squamata and Anguidae), amphibians (Caudata), insects including beetles (Coleoptera), wasps (*Vespula* sp.) and ants (Formicidae), plant matter such as *Arctostaphylos* sp., and hypogenous fungi (Grenfell and Fassenfest 1979, Powell 1993, Martin 1994, Zielinski et al. 1999, Zielinski and Duncan 2004, Golightly 2006).

While California fishers share some general dietary similarities with fishers across the continental range (Golightly et al. 2006), fisher diet in California tends to be more diverse than described elsewhere in North America. Furthermore, it has been proposed that diet diversity is highest in coastal areas of Pacific states (Martin 1994, Zielinski et al. 1999, Zielinski and Duncan 2004, Golightly et al. 2006).

Both Powell (1993) and Martin (1994) comprehensively summarize studies on fisher diet across their range in North America. Unlike fishers elsewhere in their range, some recent work has found that reptiles comprised a regular component of fisher diet in both the Klamath Bioregion population and the Southern Sierra Nevada population (Golightly et al. 2006). In addition, previous dietary studies across North America have found fishers to frequently specialize on porcupine and/or snowshoe hares (Powell 1993, Martin 1994, Weir et al. 2005). However, in California, both the Klamath Bioregion and the southern Sierra Nevada sites

show extremely low occurrences of lagomorphs and porcupine in the diet (Golightly et al. 2006, Zielinski et al. 1999, Zielinski and Duncan 2004).

Variation in diet with season or sex appears to be weak. In the southern Sierra Nevada, Zielinski et al. (1999) noted that consumption of deer carrion increased from less than five percent in other seasons to 25 percent during winter months; and consumption of plant material increased with its availability in summer and autumn. Likewise, no significant sex difference in diet has been demonstrated throughout the fisher's range in the U.S. and Canada (Giuliano et al. 1989, Kuehn 1989, Powell 1993, Martin 1994). However, some variation did occur with proximity to the coast in northern California where sciurids were favored at interior sites and woodrats (*Neotomas sp.*) were favored at coastal sites. With this finding, Golightly et al. (2006) cautioned the characterization of the fisher diet as simply opportunistic, stating fishers were influenced by habitat and energetic issues as well. Some variation in diet with age has been documented in the eastern U.S. where juveniles eat more fruits than yearlings and adults, possibly because they have not yet become adequate hunters (Giuliano et al. 1989).

## **Reproduction**

The fisher breeding season generally lasts from late February to late April (Wright and Coulter 1967, Leonard 1986, Powell 1993:53). Fisher reproductive biology is distinct in that the gestation period lasts for almost a year, but implantation of the blastocyst is delayed for approximately 10 months (Wright and Coulter 1967, Powell 1993:53). During this time of embryonic diapause, the blastocyst remains in a state of arrested development until implantation is induced by increasing photoperiod (Powell 1993:53). This system of embryonic diapause allows for breeding in late winter, when it is energetically efficient for adults and still gives kits enough time to develop before the following winter (Arthur and Krohn 1991, Powell 1993:57).

Active pregnancy follows implantation in late February for an average period of 30 to 36 days (Powell 1993:53, Frost et al. 1997). Parturition typically occurs in late March or April following active pregnancy after which females are receptive for breeding within 7-10 days (Powell 1993:53, Mead 1994, Frost et al. 1997). It is theorized that ovulation is induced by copulation, although little evidence exists



for this (Powell 1993:47, Frost et al. 1997).

Average litter size is 2-3 kits with a range from 1-6 (Powell 1993:50-53). Raised in a den entirely by the female, young are born altricial with eyes and ears closed, weighing between 40-50 g (Zielinski and Powell 1994). The kits' eyes open at 7-8 weeks old. They remain dependent on milk until 8-10 weeks old, and are capable of killing their own prey at around 4 months (Powell 1993:62-70, Zielinski and Powell 1994). Juvenile females and males become sexually mature and establish their own home ranges at 1 year (Wright and Coulter 1967, Arthur et al. 1993). Some have speculated that juvenile males may not be effective breeders at one year due to incomplete formation of the baculum (Powell and Zielinski 1994).

Fishers have low annual reproductive capacity (Heinemeyer and Jones 1994, Lewis and Stinson 1998). Due to delayed implantation, females must reach the age of two before being capable of giving birth. According to Truex et al. (1998), only 50-60% of females in the southern Sierra Nevada were found to be lactating from 1994-1996. The same review paper recorded wide fluctuations in lactating females on the north coast of California: 73% (8 of 11) of females were lactating in 1995, but only 14% (1 of 7) of females were lactating in 1996, although sample sizes were small. Another recent study in the Hoopa Valley of California reported 62% (29 of 47) of denning opportunities were successful in weaning at least one kit from 2005-2008 (Higley and Mathews 2009).

## **Range and Distribution**

Our knowledge of the historical distribution of fisher in California is primarily informed by Grinnell et al. (1937). Grinnell and his colleagues produced a map of fisher distribution which included specific points where fishers were trapped from 1919-1924, and a more general boundary of the "assumed general range within past seventy-five years" (roughly 1862-1937). The authors acknowledged that in some cases the points may have represented a trapper's residence or postal address rather than an actual location where a fisher was taken.

When the Grinnell et al. (1937) range map is displayed with the natural forest vegetation of California (Figure 1), it is evident that reliance on trapping records

and interviews with trappers for depicting range likely omits some forested areas that were occupied by fisher, at least prior to European settlement in California. As an example, the map in Grinnell et al. (1937) omitted the western coastal zone of Mendocino County, and yet included coastal Sonoma and Marin counties that contain coast redwood (*Sequoia sempervirens*) forest. It is difficult to envision fisher presence in Sonoma or Marin counties without construing that fisher probably occupied the coastal redwood forest throughout its natural range. It appears Grinnell and colleagues were depicting the most recent range of fisher in California, and they included the following items as evidence that fisher occurred historically in the coastal zone of California: "From reliable testimony we conclude that formerly the fisher ranged south along the coast of northern California to Marin County. A Mr. McCall, who resided at Fort Ross, Sonoma County, for thirty years, knew of the presence of fishers at that locality in previous years...In 1913 John Briones of Point Reyes reported that a fisher was active three mile west of Inverness, Marin County. The nature of the vegetation there, together with the occurrence of mountain beaver (*Aplodontia rufa*) and other good Canadian Zone species of animals, indicates the suitability of that locality for fishers" (Grinnell et al. 1937:220). Further notation is as follows: "In 1909 Mr. Allen Sherwood, a lifelong resident of Mendocino County, told one of us (D.) that forty years previously fisher were found all along the ridges on the coastal slope of Mendocino County, but they had been trapped so relentlessly that only a very few were left. This has been the history of the fisher in many other localities (Grinnell et al. 1937:227). Records from trappers indicated that fishers were taken almost at sea level in the northwestern coast belt (Grinnell et al. 1937:218). Additionally, an early publication on California mammals describes fisher range as: "...found in the Pacific coastal region from northern California to Alaska. In California, they are limited to the high Sierras and the cool forest region north of San Francisco". A map contained in this publication notes one of the faunal distribution zones of fisher as the "Humboldt" zone, which extends narrowly along the coast from Del Norte to Marin county (Stephens 1906).

The overall distribution of fisher in California was described by Grinnell et al. (1937:214-215) as occurring: "In general, forested areas of the higher mountain masses north of the Thirty-fifth Parallel. In detail, in the northwestern part of the State south from the Oregon line to Lake and Marin counties and east to and including Mount Shasta; not often in the immediate coastal region (redwood belt)

nor, so far as known at present, in the Warner Mountains, Modoc County; south from Mount Shasta and Lassen peak throughout the main Sierra Nevada to Greenhorn Mountain, in north central Kern County...Belongs to middle altitudes, 2000 ft. (near sea level occasionally) to 5000 ft. at the north, ordinarily 4000 ft to 8000 ft. in the Mount Whitney region, although vagrant individuals go beyond these limits; for example, to as high as 10,900 ft. near Mount Lyell”.

As noted in Schempf and White (1977) and Zielinski et al. (2005), the fisher distribution map in Grinnell et al. (1937) omitted trapping records in Lassen County near Eagle Lake that were noted in the text (page 219) as follows: “The only records that we have of fishers being taken east of the main Sierran Divide are of two trapped in the winters of 1920 and 1930 on the ridge just west of Eagle Lake, Lassen County”. This notation differs slightly from that found in Grinnell et al. (1930) that reads as follows: “We were told that a fisher had been taken by a trapper at Eagle Lake in 1920. The pelt sold for sixty-five dollars. People who live in the section say that fishers are sometimes trapped in the “lake country” to the west of Eagle Lake”. Taken collectively, these 2 notations appear to indicate fisher were present in the Eagle Lake area, and to the west of it at least from 1920-1930.

It is well documented that timber harvest in the coast redwood ecosystem of California was important in the latter half of the 1800’s and there was much human activity. Hilgard (1884:56) noted “The redwood belt is at present the most important timber region of the state, redwood being one of the chief varieties of lumber used in construction”. He also noted: “The valley of Russian river, in southern Mendocino and northern Sonoma counties...for 15 miles from its mouth had originally a timber growth of redwood, but now [1884] has only scattered groves of oak”. Carranco (1982:13) noted coast redwoods “...are highly conducive to logging and have provided commercial lumber since the 1770’s”. By the first half of the 1800’s, California’s northwestern forests had been known to Europeans for almost a century, and the latter were making increasing use of the towering redwoods (Carranco 1982:15). Along the Mendocino coast, by the 1880’s there was “a mill in every gulch”, and during that decade, seventy-six landings existed between Bodega head and Humboldt Bay (Carranco 1982:105). From 1860 to 1884, “tremendous quantities of timber were cut, and over 300 schooners worked the coast” (Carranco 1982:107). Thus, by the time Grinnell

and colleagues were attempting to map fisher distribution in California, habitat loss and modification were underway and was affecting fisher habitat; and undoubtedly direct pressure on fisher populations from trapping and killing of animals was occurring.

Land use changes were also occurring in the Sierra Nevada beginning with the Gold Rush era. Hilgard (1884:60-61) noted the following regarding the Sierra Nevada: "The entire Sierra region, as a whole, is sparsely inhabited ...In summer time large herds of stock, especially sheep, are driven to the mountain pastures from the plains...Lumbering and mining constitute the chief industries of the extremely sparse population...". Further details on the progression of substantial land use changes in the Sierra Nevada (e.g., mining effects, timber harvest, fire suppression, and sheep grazing) are summarized in Sudworth (1900), McKelvey and Johnston (1992), and Beesley (1996). Within this range, it must be assumed that trapping and killing of fisher (along with most other wildlife species of value) would have occurred.

From the historical information on habitat change described above, more recent information summarized below, and from forest vegetation distribution, the Department's "California Wildlife Habitat Relationships" (CWHR) program prepared a range map for fisher in California. The CWHR estimated range is depicted in comparison to the Grinnell et al. (1937) range (Figure 2). The CWHR range was also used recently in a paper describing fisher habitat models in California (Davis et al. 2007).

As part of evaluating the current range and distribution of the fisher in California, and in order to determine the proportion of range that may no longer be inhabited by fisher, we compiled as much information as possible during the petition review and status review periods. We used records from the California Natural Diversity Database (CNDDDB) and other databases on fisher maintained by the Department. Additionally, we digitized occurrence points from reports that were provided during the petition and status review periods, and contacted researchers, and private and public sources for fisher occurrence information. The results of our compilation of historical and recent records are depicted in Figure 3. The records are broken down into date periods as follows:

- 1896 - 1924 covers the first records of fisher in California through the end date of the Grinnell et al. (1937) map;
- 1925 -1946 covers the period after the Grinnell et al. (1937) map to the end of legal trapping of fisher;
- 1947 - 1987 covers the post-trapping period, and compilations of sighting information by Schempf and White (1977) and Gould (1987);
- 1988 – 2009 covers the more recent period (last twenty years) when studies and distribution surveys were initiated for fisher throughout California.

Maps that depict “sighting” information must be viewed with caution and in conjunction with additional information to determine if the records have been screened for reliability in some manner. Some observations may be in error where the forest visitor or biologist actually observed an American marten, or another mustelid, or some other forest carnivore. Aubry and Jagger (2006) noted that anecdotal occurrence records such as sightings and descriptions of tracks, cannot be independently verified and thus, are inherently unreliable. They and others have promoted the use of standardized techniques that produce verifiable evidence of species presence (remote cameras and track-plate boxes) (McKelvey et al. 2008). The Department supports such an approach, but recognizes the potential value of information from trappers records, and sighting information provided by experienced biologists, naturalists, and foresters. Given that Grinnell et al. (1937) relied heavily on personal communication with trappers to delineate fisher range, we believe that records from trappers probably have the most validity, even without a specimen for verification.

Although the records in Figure 3 have not been screened and ranked for reliability, we present these occurrences as the best information available and provide an overview of the variety of forested habitats reportedly occupied by fisher over the period of 1896-2009, and help define the range of the species in California. Inclusion of these anecdotal points in the Sierra Nevada is not without controversy as one peer-reviewer (K. Aubry 2010, App. B) argued the “uncertainty” of them. The Department agrees that few could be proven without

question.

Additional information on fisher distribution was provided to the Department during the petition review period and is contained in Appendix D (maps created by the Service as part of the candidate conservation agreement with assurances with Sierra Pacific Industries). Comparing these maps (Figure 3; and Figures 1 and 2 in Appendix D) reveals the two areas of fisher occurrence in California today: northern California (including the Yolla Bolly Wilderness/Mendocino National Forest area) and the southern Sierra Nevada.

There is reliable evidence of former presence of fisher in the central and northern Sierra Nevada from the Placerville area and Tahoe National Forest. One such record is in the form of a table labeled “Incomplete Record of Fur-bearers killed in National Forests in 1914”. Ten fisher are listed as having been killed on Tahoe National Forest in 1914 (CA Fish and Game 1916). Trapping licenses were not required in California until August of 1917 (CA Fish and Game 1917). A subsequent publication noted that Mr. E. R. Skinner of Sacramento, “the largest fur buyer on the Pacific Coast”, paid \$2.50 for the pelts of 5 fishers killed during July 1916 near Placerville, California (CA Fish and Game 1917). Additionally, a former Department biologist (Craig Swick) interviewed trappers and noted one fisher was found by dogs in the Taylorsville area in 1946 (approximately 106 km south of the Pit River), and one fisher was trapped in 1943 near Frenchman Lake (approximately 151 km south of the Pit River). The trapper in both cases was J. Foster (Schempf and White 1977). These records, combined with the Eagle Lake records, and the locations depicted in the central and northern Sierra Nevada in Grinnell et al. (1937) provide evidence of fisher occurrence in the region from approximately 1914-1946.

In the redwood zone of northern California, systematic efforts to better define the current range and distribution of fisher by verifiable and repeatable methods included work in Del Norte and Humboldt counties (Beyer and Golightly 1996, Slauson et al. 2003), and in Mendocino County (Douglas 2008; Nelson and Valentine 2008). Neither of the latter two studies detected fisher. Surveys on Mendocino National Forest were conducted by Weinberg and Paul (2000) and Slauson and Zielinski (2007), and fisher were detected.

The most systematic and broad scale work in other parts of the state occurred from 1989-1994 (Zielinski et al. 1995), from 1996-2002 (Zielinski et al. 2005), and from 2002-2009 (USDA 2006, USDA 2008, Truex et al. 2009). The results of the survey effort for the 1996-2005 period on federal lands is shown in Figure 4. Fishers were not detected across an approximately 270 mi (430 km) region, from the southern Cascades (eastern Shasta County) to the southern Sierra Nevada (Mariposa County); and essentially the same remains true through 2009. As noted in Zielinski et al. (2005), a comparison of historical and contemporary records for fisher suggests a gap in the distribution of fisher in the Sierra Nevada (although this may now be partially confounded by the preliminary genetic work described later suggesting the separation has been in place for thousands of years). If historically, fisher were continuously distributed through the Sierra Nevada, the gap would be of concern because it is more than four times the known maximum dispersal distance for fisher (100 km; York 1996). The gap in distribution is in contrast to the range map and statement in Grinnell et al. (1937:215) that fisher occurred "...throughout the main Sierra Nevada". Given the natural distribution of forest vegetation in California, there is no reason to doubt this description of fisher range by Grinnell and colleagues. The Department acknowledges that fisher may occur in these areas of the Sierra Nevada, however, if they do, their numbers are so low as to make them undetectable via standard methods that have been used to date. The most recent information available involving the gap area supports the hypothesis that fisher have not dispersed north across the Merced River (R. Barrett, 2010, App. B).

Because recent surveys in coastal Mendocino County have failed to detect fisher, and due to the paucity of sighting records for fisher in CNDDDB for coastal Sonoma and Mendocino counties (refer to Figure 3), it appears that fisher are rare or absent in this area of California as well. The Department's estimate of historical range no longer inhabited in California is approximately 43% (Figure 5).

### **Land ownership patterns in fisher range**

In order to better understand land management and land use factors that may be affecting fisher distribution and abundance, and to help analyze the severity of threats to fisher, the Department examined land ownerships (Figure 6). The pie

chart in the lower left-hand corner of this figure breaks down land ownership percentages within the CWHR range of fisher in California. The majority of fisher range is in federal ownerships (approximately 62% overall), with USDA Forest Service (USFS) land at approximately 52 percent, and National Park Service (NPS) lands at approximately 7 percent. Private, including tribal, lands comprise approximately 37 percent of the estimated fisher range. State lands comprise about one percent of fisher range. However, distribution of the various ownerships is varied, with a large amount of private land in the coastal zone of northern California from Sonoma county northward, and scattered private lands, sometimes in larger blocks, and other times in checkerboard pattern with USFS and NPS lands, from northcentral California to Tuolumne County (just north of Yosemite National Park). The southern Sierra Nevada is primarily USFS and NPS lands south of the Merced River.

Figure 7 illustrates fisher range, ownership, and distribution knowledge in the southern Sierra Nevada. Lack of information and surveys within the national park boundaries is evident, but does not necessarily mean that fisher are absent, but that more effort is needed within the parks. From work by Boroski et al. (2002), Green (2007), and the researchers noted in the legend of Figure 7, it is considered that fisher occur primarily in a continuous band of low to mid-elevation forest on the western slope, rarely ranging above 3,000 m. Fisher have rarely been detected north of the Merced River in the last 20 years (L. Chow, pers. comm; Zielinski et al. 2005a). Some limited surveys on the Stanislaus National Forest have not detected fisher (J. Buckley, pers. comm). Thus, for unknown reasons, fisher have not moved north of the Merced River at any substantial level thus far.

Weinberg and Paul (2000) conducted carnivore surveys in two watersheds within the Mendocino National Forest: the Black Butte watershed in western Glenn County and northeastern Mendocino County, and the Stony watershed in northwestern Colusa County and northeastern Lake County. During those surveys, fishers were detected in the Black Butte watershed but not in the Stony watershed. A more recent carnivore survey effort was conducted on the Mendocino National Forest detected fishers in the Stony watershed, and also at other locations in northern Lake County south of the Black Butte watershed (Slauson and Zielinski 2007). In light of their results, Slauson and Zielinski



(2007) stated “Overall, fishers appear to be distributed throughout most of the historical range included in the geographic extent of our surveys.” Although Slauson and Zielinski concluded that fishers are largely distributed throughout their historical range in the area, they also cautioned that their results do not permit an evaluation of whether or not there has been a reduction in the overall number of locations historically occupied by fishers.

It is possible that the range of fishers may have expanded westward in coastal northwestern California. Slauson and Zielinski (2004) compared the location of recent fisher detections to the range map provided by Grinnell et al. (1937) and other unpublished trapping data and speculated that fishers may have recently increased their distribution into coastal redwood forests in Humboldt and Del Norte Counties. In the late 1960s and early 1970s, it was noted that fishers were increasing in Humboldt and Trinity counties (possibly related to recovery from trapping) and the authors attributed it as possibly related to the increase in porcupines (*Erethizon dorsatum*) throughout these counties (Yocom and McCollum 1973). The spread of porcupines into the area appears to have been associated with the cutting of the virgin stands of redwood and Douglas fir forest. An abundance of food was created by plant succession which resulted from logging; thus, porcupines invaded the entire area even to the ocean beaches (Yocom 1971). It may be that fisher responded to this change in prey distribution, but definitive conclusions cannot be made because there is only sighting data to rely on from Yocom (1971) and from Yocom and McCollum (1973).

Appendix D contains fisher distribution maps that were in supporting documents written by the U.S. Fish and Wildlife Service for the Sierra Pacific Industries Candidate Conservation Agreement with Assurances. The distribution of these recent (1995-2008) fisher observations mapped from several studies and surveys conducted throughout northwestern California (exclusive of the coastal zone in Mendocino, Sonoma, and Marin counties) is roughly similar to the distribution of 1919-1924 trapping locations mapped by Grinnell et al. (1937). However, neither the modern observations nor the historical trapping locations represent complete surveys of fisher distribution during each period. The historical records from Grinnell et al. (1937), in particular, only represent the fishers reported to have been trapped during a five year period. These records and other records housed

by the Department are the best data available on the historical distribution of fishers in California. One area in California in need of survey effort to better define current fisher distribution is the forested region of eastern Siskiyou and western Modoc counties. Though excluded by Grinnell et al. (1937), it appears the forested region is naturally connected to occupied fisher habitat to the west. This gap in historical and current knowledge of fisher distribution is indicated by a map depicting results of some fisher survey efforts in the vicinity (see Davis et al. 2007, Figure 1).

Finally, for clarification, the review here on the fisher has been more comprehensive and thorough than that used as the basis for the case study in the California Wildlife Action Plan. As such, the plan's identification of logging as the reason for extirpation of fisher in much of the Sierra Nevada (page 301 of plan) did not have the benefit of the consideration and evaluation of the information involved in this review. Therefore, the conclusion in the wildlife action plan regarding the reason for extirpation of fisher in much of the Sierra Nevada must be qualified in this respect.

### **Summary of Range and Distribution**

Fisher distribution in California today is represented by two populations, the northern California population that ranges over approximately 10 million acres, and the smaller area southern Sierra Nevada population (approx. 2.6 million acres of range). Fisher apparently no longer inhabit the areas comprising Marin, Sonoma, and most of Mendocino County, and generally between the Pit River in the northern Sierra Nevada/Cascades to the Merced River in the southern Sierra Nevada. These two populations are separated by approximately 270 miles (430 km). There is little empirical evidence of fisher previously inhabiting this gap in the Sierra Nevada range and we are largely relying on observation data and on trapping reports and distribution accounts described by Grinnell et al. (1937). Thus, as much as 43 percent of historical range is either: 1) not inhabited by fisher now; 2) is not part of historical range; or 3) fisher are extremely rare in this area. In this geographic area, there have been a handful of reported observations since the 1910-20 period. Overall, the Department concludes that there has not been substantial change in fisher distribution since the Grinnell period of the 1920's, and that natural recolonization of fisher to this believed

historical range in any detectable number has not occurred.

Understanding of the reasons for the Sierra Nevada “gap” in fisher distribution are now confounded by the preliminary genetic analysis indicating separation of the northern and southern populations for thousands of years. This would suggest that some portion of this range was not continuously inhabited by fisher (K. Aubry, 2010, App. B). The range losses that are believed to have occurred are best explained by exploitative trapping in the early decades of the 1900’s; with recolonization success hypothesized to be hindered by habitat modification from timber harvesting, other human-caused factors, and limited dispersal capability of fisher. With or without the new genetic information, it is unlikely the true historical distribution of fisher in the gap area can accurately be determined; densities or population estimates from that period certainly cannot be determined.

### **Habitat Necessary for Survival**

The fisher requires forested habitats that will fulfill its life history for breeding, resting, and foraging to survive. Fisher in California are well known for selecting late successional forest structures for resting and denning, but also may select younger age forest characteristics for foraging (Zielinski et al. 1999). Forest cover may benefit fishers by providing protection from predators, lowering energy required for travel between foraging or resting sites, providing a favorable microclimate, and increasing prey abundance and vulnerability (Buskirk and Powell 1994, Powell and Zielinski 1994). More recent information, such as received in response to the petition, has indicated fisher also inhabit forests that are not late successional but do contain elements for resting and denning (Appendix C).

As it relates to the petition, the management and history of late successional forest timber harvesting in California is somewhat used as a habitat surrogate to infer conditions and fate for the fisher population. However, use of a specific habitat as a surrogate to infer a species trend risks being incorrect if new information is advanced that the relationship may not be as direct or specific as originally believed. In the case of the fisher, there are now increasing examples of fisher occupying other forest habitats that are not considered late seral, but

that do contain late seral elements.

Fishers use a variety of forest types in California, including redwood, Douglas-fir, Douglas-fir – tanoak, white fir, mixed conifer, mixed conifer-hardwood, and ponderosa pine (Klug 1997, Truex et al. 1998, Zielinski et al. 2004). Tree species composition may be less important to fishers than components of forest structure which affect foraging success and provide resting and denning sites (Buskirk and Powell 1994). Forest canopy appears to be one of these components, as moderate and dense canopy is an important predictor of fisher occurrence at the landscape scale (Truex et al. 1998, Carroll et al. 1999, Zielinski et al. 2004b, Davis et al. 2007). Primary fisher habitat is dense coniferous forest, usually with a deciduous component and abundant physical structure near the ground. The fisher is considered a forest habitat specialist, limited in distribution to forest and habitat nearby (Buskirk and Zielinski 2003:208). In general, based on a number of studies in eastern North America and in California, high canopy closure and a general avoidance of areas with low canopy closure are important components of fisher habitat relationships, especially at the rest site and den site level (Powell and Zielinski 1994, Truex et al. 1998, Carroll et al. 1999, Mazzoni 2002, Zielinski et al. 2004b). At the stand and site scale, forest structural attributes considered beneficial to fishers include a diversity of tree sizes and shapes, canopy gaps and associated under-story vegetation, decadent structures (snags, cavities, fallen trees and limbs, etc.), and limbs close to the ground (Powell and Zielinski 1994).

Such forest structure can be characterized by a diversity of tree sizes and shapes, light gaps and associated understory vegetation, snags, fallen trees and limbs, and limbs close to the ground (Buskirk and Powell *in* Powell and Zielinski 1994). Fisher populations fluctuate with populations of prey, and fisher population densities vary with habitat and prey (Powell and Zielinski 1994). Fishers have to balance their need to obtain prey resources year-round and to avoid predation on themselves or their young, while maintaining homeostasis by selecting favorable microclimates within the forested landscape for foraging, denning, and resting. Their movements and habitat selection are also likely influenced by innate behaviors designed to avoid or minimize intra- and interspecific competition.

Fisher home ranges in California often include a variety of forest types and successional stages (Truex et al. 1998, Self and Kerns 2001, Matthews et al. 2008, Zielinski et al. 2004b). However, relatively few California studies have included detailed analyses of habitat within the home ranges of individual fishers. Zielinski et al. (2004b) found that approximately 70% male and female home ranges at Pilot Creek in northwestern California were comprised of mid and late-seral vegetation. In the Tule River area of the southern Sierra Nevada, stands with trees 29–61 cm dbh and 60 - 100% canopy closure comprised most of the male and female home ranges. More than 80% of fisher home ranges (both sexes) were in stands with >40% canopy closure (Zielinski et al. 2004b).

Life history characteristics of fishers, such as large home range, low fecundity, and limited dispersal across large areas of open habitat are thought to make them particularly vulnerable to landscape-level habitat alteration, such as extensive logging or loss from large stand replacing wildfires (Powell and Zielinski 1994, Lewis and Stinson 1998). Buskirk and Powell (1994) found that at the landscape scale, the abundance and distribution of fishers depended on size and suitability of patches of preferred habitat, and the location of open areas in relation to those patches. The response of fishers to forest fragmentation is dependent on the size, characteristics, and spatial arrangement of the remaining habitat.

Large areas without overhead canopy cover may create barriers to dispersal and hinder efforts to maintain or enhance fisher populations. However, fishers are known to use large areas of less desirable habitat (e.g., recently logged areas) if remaining patches of trees are available for cover (Weir 2003). Fishers are negatively associated with clearcuts and habitats that are nearly or completely surrounded by clearcuts (Rosenberg and Raphael 1986). However, the size of clearcuts, retention of habitat elements within them, and their age are likely important factors relative to their effect on fishers. Kelly (1977) documented fishers using clearcuts in the summer when a dense canopy of hardwood saplings was present, but not using those areas in winter when hardwoods had shed their leaves.

### **Habitat for Denning and Resting**

Fishers give birth in natal dens and structures subsequently used by a female and her young are termed maternal dens (Lewis and Stinson 1998). A female fisher will generally use 1-3 dens per litter of kits (Powell et al. 2003). Natal and maternal dens are generally found in tree cavities and tend to be located well above the ground (Buck et al. 1983, Weir 1995, Truex et al. 1998, Powell et al. 2003). Average heights of dens above ground have been reported as 10.6 m in California (Buck et al. 1983), 18.0 and 21.4 m in Oregon (Lewis and Stinson 1998), and 25.9 m in British Columbia (Weir 1995). Paragi et al. (1996) stressed the importance of cavities as natal dens for fishers and subsequent studies have supported this (Higley et al. 1998, Truex et al. 1998, Self and Callas 2006, Higley and Matthews 2006). The species of tree may be less important to fishers for denning than its structural characteristics (Zielinski et al. 2004b).

A number of natal and maternal den trees for fisher have been identified in California and include the following species: California black oak (*Quercus kelloggii*), Canyon live oak (*Quercus chrysolepis*), Oregon White Oak (*Quercus garryana*), Tanoak (*Lithocarpus densiflorus*), Pacific Madrone (*Arbutus menziesii*), Golden Chinquapin (*Chrysolepis chryosphylla*), Douglas-fir (*Pseudotsuga menziesii*), Big-leaf maple (*Acer macrophyllum*), Incense Cedar (*Calocedrus decumens*), White fir (*Abies concolor*), Port Orford Cedar (*Cupressus lawsoniana*), Western Red Cedar (*Thuja plicata*), Sugar Pine (*Pinus lambertiana*), Ponderosa Pine (*Pinus ponderosa*), and coast redwood (Truex et al. 1998, Ewald 2003, Matthews et al. 2008, Reno et al. 2008).

Fishers use rest sites across their home ranges, and appear to reuse particular structures infrequently (Kilpatrick and Rego 1994, Seglund 1995, Mazzoni 2002, Zielinski et al. 2004a, Yaeger 2005). Common resting structures in live trees include cavities, large branches, mistletoe clumps, and raptor and squirrel nests. Snags, logs, stumps, rock and brush piles, and holes in the ground are also used (Grinnell et al. 1937, De Vos 1952, Coulter 1966, Arthur et al. 1989a, Powell 1993, Kilpatrick and Rego 1994, Zielinski et al. 2004b, Yaeger 2005). Zielinski et al. (2004a) reported that female fishers tended to use cavities in standing trees for resting more often than males, while males used platforms in trees significantly more frequently than females.

Fishers predominantly use live trees as rest sites (Jones 1991, Seglund 1995,

Truex et al. 1998, Zielinski et al. 2004b, Yaeger 2005) and rest sites are often located in large trees (Buck et al. 1983, Seglund 1995, Weir and Harestad 2003, Zielinski et al. 2004a, Yaeger 2005). Large trees are more likely to have large lateral limbs, pockets of decay, horizontal fan-shaped branch arrays, and cavities that provide potential resting sites (Yaeger 2005). In a southern Sierra Nevada study, Zielinski et al. (2004a) found that trees used as resting structures, and those in the immediate vicinity of the rest structure, were “among the largest standing live and dead trees within fisher home ranges.”

Appendix C contains a compilation of den and rest site attributes from select studies in California and elsewhere. A summary table description of natal and maternal dens and surrounding habitat from 3 study areas in California is also in this appendix (Truex et al. 1998: Table 4). The mean dbh of 9 conifer den sites was 45 in (31-58 in), and the mean dbh of 8 hardwood den sites was 25 in (16-39 in). Across the three study areas, canopy cover at these natal and maternal den sites was high, ranging from 70-100%.

The means noted above from the Truex et al. (1998) study correspond fairly closely with results from other fisher studies in California (see Table 2 from the SPI CCAA, and Table 13 from Matthews et al. 2008; den sites on Hoopa Tribal Forestry land, in Appendix E), and with ongoing studies in the southern Sierra. Large sample sizes of natal and maternal den sites are available from Hoopa now that over 3 years of field work have occurred.

Fisher rest sites were also compiled for three study areas by Truex et al. (1998: Table 6). This information is also in Appendix E, along with table 7 from the same study. From table 6, it can be seen that dbh of fisher rest sites in conifers across the three studies averaged 30-44 inches, and the dbh of rest sites in hardwoods across the three studies averaged 19-34 in. Table 7 in Appendix E shows that even at rest sites, canopy cover was high, approximately 88-94%. Table 1, a compilation by the Service for SPIs CCAA is also included in Appendix E for comparison with other studies. In general, for all these studies, the mean dbh of conifer species exceeds the mean dbh of the hardwood species.

In a study of fisher rest sites in the southern Sierra Nevada, fishers used the largest woody structures for resting bouts, but they also used numerous

structures. The observation that individual resting structures were rarely reused is similar to that reported elsewhere (e.g., Seglund 1995) and suggests that fishers do not restrict use of their home range to a few central locations but instead require multiple resting structures distributed throughout their home ranges (Zielinski et al. 2004a). In another study in the southern Sierra Nevada, Mazzoni (2002) also noted that infrequent re-use of rest trees suggested a need for numerous quality rest sites within the home range of an individual fisher. Her findings also suggested large trees (related to occurrence of large snags and logs), along with dense and multi-layered canopies contributed to quality resting habitat for fishers. Older, large trees have structural attributes suitable for fisher resting such as cavities, large branches and mistletoe brooms, along with dense canopies that younger trees may lack. In her particular study area, there was a high incidence of dwarf mistletoe broom in rest trees. Stand level habitat characteristics found to be associated with fisher rest sites were high crown volume, canopy layering in stands with >60% cover, basal area, log cover, and a high number of large snags.

Fisher use late seral elements for rest and den structures, and such elements need to be maintained and recruited so that high canopy cover and complex forest structure are perpetuated. This is complicated by the fact that large live trees are among the most slowly renewing elements of the forest and are dominant elements in forest communities. Conifers and hardwoods may take hundreds of years to develop the size and the decadence necessary to be used by fishers for resting (Zielinski et al. 2004a).

### **Habitat for Foraging**

Fisher habitat use while foraging has been inferred from estimated locations of active, radio-collared fishers and comparing conditions at camera and track-plate stations where fishers were and were not detected. Active fishers studied at the Hoopa Reservation in northwestern California did not exhibit habitat selection within their home ranges (Matthews et al. 2008).

High canopy cover may be an important habitat component for foraging habitat although foraging habitat requirements are not well understood. Presumably, fisher are usually foraging when detected with track plate devices or cameras. In



a track plate study in the southern Sierra Nevada, canopy cover  $\geq 40$  percent was associated with fisher detections (Green 2007). Placement of track plate devices and cameras however, may/may not be representative of all habitats available to the fisher. In the southern Sierra Nevada there potentially could be a broader use of habitat types than in Northern California (Davis et al. 2007); this is also supported by the varied diet reported in the petition (citing Zielinski work) that included reptiles and mule deer, species not regarded as late successional dependent species.

### **Fire Maintained Habitat**

Another essential habitat element for fisher in California is a fire-maintained forest. Fire is a natural and essential component of California forest lands inhabited by fisher, and fisher evolved with natural fire patterns in California. However, years of fire suppression activities have led to a build-up in fuels that could lead to catastrophic fires that have the potential to modify fisher habitat.

### **Abundance**

Fishers are not considered to be an abundant species given their place near the top of the food web as a carnivore. Grinnell et al. (1937:227) noted that “Fishers are nowhere abundant in California. Even in good fisher country it is unusual to find more than one or two to the township”. There are no historical studies of fisher population size, abundance, or density in California. What is generally understood is that fisher population densities are low relative to other mammals, and can undergo fluctuations that are related to their prey (Powell 1993:78, Powell and Zielinski 1994, R. Barrett 2010, App. B).

Concern over fisher populations occurred during the course of Grinnell’s field work. Dixon (1925, who was one of the co-authors of the 1937 work) separately concluded that the California fisher population was dangerously close to extinction and proposed that measures be taken to protect the species from trapping. However, it was not until 1946 that trapping for fisher was prohibited (Gould 1987). Trapping of fisher was apparently accomplished primarily through

the use of dogs trained to tree fisher or with traps specifically set for the fisher (Grinnell et al. (1937).

Grinnell et al. (1937) considered fisher to have been "...trapped so relentlessly..." as the reason for the reduction of fisher numbers in many localities in California, but they also cite several reasons for why trapping had the effect it did. They believed the decrease in the fisher population was not local, but involved "...nearly the entire habitat of this animal". They noted the following in describing the reduction in fisher: 1) The fisher is by nature a solitary animal; 2) Its food habits and requirements are such that each fisher requires a large amount of forage territory in order to live; 3) The areas suitable for fishers to live in are limited; 4) The rate of reproduction of the fisher is relatively low; and 5) The forests in which the fisher lives are being reduced by timber-cutting. They wrote that all of these factors tend naturally to limit the fisher population, and because of the high value of pelts at the time, that "fishers have been unable to withstand this augmented and unnatural toll levied upon them."

Grinnell et al. (1937) made a rough estimate of the fisher population in California, based on their 1920's assessments of trapping. They suggested fisher were nowhere abundant in the State with 1 or 2 animals per township (36 square miles) in good fisher range; and fewer than 300 statewide. Lewis and Zielinski (1996) in summarizing historic trapping data, reported that fisher harvest declined substantially after the 1920's until trapping was finally halted in 1946 (Figure 12). The value of each fisher pelt during the era was high such that the fisher would be a valued resource. The estimate of 300 animals cannot be verified; what can be assessed and compared to a limited extent is the trapping information on fisher over time.

The low population estimate, and the recommendation from Dixon (1925) and Grinnell et al. (1937) to cease trapping in the State, are suggestive that intensive trapping was the primary mechanism affecting fisher numbers. For perspective, the Department notes the substantial numbers of fisher being captured for radio-collaring/study purposes in various studies in the present day compared to the Grinnell et al. (1937) accounts of low trapping success in the mid-1920's and decreased ability of trappers to find fisher. For example, by summer 2009, the two southern Sierra Nevada studies had captured 47 and 44 fisher in their

particular study areas since February 2007 and December 2007, respectively (Purcell et al. 2009, Sweitzer and Barrett 2009). The Department led translocation project in northern California was able to capture 19 fisher within a two month period between November 24, 2009 and January 24, 2010.

## **Northern California**

Despite the paucity of empirical data, efforts to estimate or model fisher population size in northern California do exist. In a petition to list the fisher pursuant to the federal Endangered Species Act, a preliminary estimate by Dr. Carlos Carroll of 1,000-2,000 fishers in northern California was cited (Greenwald et al. 2000). According to that petition, the estimate was based primarily on a probability model of likelihood of fisher detection (Carroll et al. 1999) and density estimates derived primarily from the Hoopa Valley Indian Reservation. To develop the estimate, Carroll assumed fishers have access to all suitable habitats and that the Hoopa fisher population was in equilibrium. It is unknown whether these assumptions are true, which would affect the accuracy of the population estimate.

In April 2008, Carroll indicated that his analysis of fisher data sets from both the Hoopa Reservation and the Six Rivers National Forest in northwestern California suggest a regional (northern California and a small portion of adjacent Oregon) fisher population of 1,000-3,000 animals (C. Carroll, pers. comm.). This estimate represents the rounded outermost bounds of the 95% confidence intervals from the analysis. Carroll acknowledged a substantial lack of certainty regarding the population size, as evidenced by the broad range of the estimate. However, he believed the estimate to be useful for general planning and risk assessment.

Self et al. (2008 SPI comment information) derived two separate “preliminary” estimates of the California fisher population. The authors compiled or developed fisher density estimates for specific locations based on previous field studies. Using these density estimates, the authors used a “deterministic expert method” and an “analytic model based approach” to estimate regional population values. The “deterministic expert” approach involved extrapolating the density estimate values from the specific studies to larger geographic areas in the vicinity of the study areas, such that a density value was estimated for all areas within the

currently occupied portion of the fisher's range. The area of conifer and mixed conifer-hardwood forest below a specific elevation (from 5000 feet in the north to 8000 feet in the south) was calculated within each of these areas, and multiplied by the estimated fisher density to calculate a fisher population number in each area.

In the model-based approach, Self et al. (2008) generated several hypotheses about environmental conditions that might affect fisher density. For each hypothesis they described independent variables which could be used to explain and test each hypothesis, and developed a regression model to determine which combination of independent variables best explained the estimated fisher density in each study area. They then applied the regression model across individual Public Land Survey townships within the range of the northern and southern fisher populations, excluding some areas due to elevation and habitat constraints, as done in the deterministic expert approach. The overall fisher population estimate was calculated from the estimated number of fishers within each township in the occupied range.

The deterministic expert method provided an estimate of 3,079 fishers in northern California, and the model-based regression method estimate was 3,199 (95% confidence interval [CI]: 1,848 - 4,550) fishers. Estimates for the southern Sierra Nevada population were 598 and 548 (95% CI: 247 – 849) fishers, respectively. While cautioning that their estimates are preliminary, the authors emphasized the similarities between the separate estimates.

The results should also be interpreted cautiously because it is unclear if all of the density estimates from the underlying studies are sufficiently robust for inclusion in the meta-analysis, and if all available density estimates were included in the development of the model. Estimating fisher density was an explicit goal of only a few of the studies utilized in the meta-analysis. For example, the density values for the North Coast and southern Sierra study areas were described in the original paper as “grossly estimated” (Zielinski et al. 2004b) for the purposes of providing readers a general idea of comparative densities at different sites (W. Zielinski, pers. comm.). Another potential source of error in the deterministic expert method involves extrapolating the density values from specific study areas (perhaps chosen due to a prior knowledge of fisher

abundance in those areas) to much larger landscapes. Survey data suggests that fishers are generally not uniformly distributed across all conifer and hardwood/conifer habitats in California (Carroll et al. 1999, Dark 1997, Slauson et al. 2003, Slauson and Zielinski 2007, USDA 2008, USDI Fish and Wildlife Service, unpublished data).

Thompson (2008) in a recently completed telemetry study (thesis) of fisher in north coastal California reported substantially higher densities of fisher than studies using similar methods conducted in the 1980's. Thompson (2008) further cautioned about the methods used to calculate density using home range versus mark-recapture methods and advocated consistent approaches to calculate what the Department would consider to be "minimum" density estimates.

The estimates described above are preliminary and have not been peer-reviewed or published. The Department is supportive of efforts to learn more about the northern California population, but recognize that basic distribution work may be needed first, or concurrently, along with habitat mapping, to more fully understand the extent of occupied range and to estimate populations.

### **Southern Sierra Nevada**

The northern and central Sierra Nevada is considered by some investigators to be currently unoccupied by fisher (Truex et al. 1998, Zielinski et al. 1997b, 2000, 2005a, Campbell 2004). As indicated previously, the Department is not prepared to make that conclusion without additional surveys that are more comprehensive in terms of evaluating the entire potential range for fisher. However, for purposes of this review, the Department will consider that there are no confirmed fisher in this geographic area at the present time (excluding the current translocation animals discussed later).

The balance of this section focuses on the southern Sierra Nevada. There is not yet adequate empirical data to accurately estimate the population of fisher in the southern Sierra Nevada. The Department understands that comprehensive and objective surveys of the fisher population throughout their southern Sierra Nevada are underway through the U.S. Forest Service (R. Truex, pers. comm, Jan. 2010; K. Aubry, 2010, App. B). Population estimates that do exist rely on

models that are derived from short-term studies of fisher using telemetry and/or detection methods. Particularly missing in the analyses of populations are surveys/studies in the Kings Canyon-Sequoia and Yosemite national parks, and their contribution to the population.

For the southern Sierra Nevada fisher population, a modeling exercise, an analysis of fisher habitat suitability, and fisher population estimates were recently completed in an effort to establish a baseline population (Spencer et al. 2008). There were many caveats associated with the output from this modeling exercise, and the authors weighed the various uncertainties in all their assumptions and concluded with a population estimate of between 160 and 360 individuals (not including juveniles). The number of adult females was estimated at 55-120 individuals, but the effective population size is unknown and additional studies are needed. The authors believed that because the population does not experience immigration from other regions, it is at risk of extirpation by a variety of causes, including stochastic influences.

Three different methods were used to derive the best estimate of population size noted above:

- One static approach was to extrapolate fisher density estimates from the Kings River study (Jordan 2007) over the area predicted to be suitable by habitat models.
- Another static approach supplied by R. Truex (U.S. Forest Service) was to apply sampling theory from southern Sierra fisher monitoring data to calculate annual fisher occupancy rates, adjusting for detectability and characteristics of the sample population, to derive a total population size based on the number of fishers presumed to be detected at each sample unit.
- A dynamic approach applied the spatially explicit population model PATCH to estimate the equilibrium population size (or carrying capacity) of fishers in currently occupied habitat areas, and to identify likely source, sink, and population expansion areas.

The three methods yielded relatively the following population estimates:

- Jordan: 285-370 fisher, young and adults, with 57-86 adult females;
- Truex: 160-250 fisher, young and adults.
- PATCH modeling: 142-294 adult fishers, with 71-147 adult females; accounting for subadult fishers provides a rough estimate of 220-360 total fishers for the southern Sierra population.

From the Department's perspective, some of the methodology and assumptions used in the Spencer et al. (2008) analysis (as well as the authors statements about limitations) limits reliance on it although it currently represents the best analysis available and points to a population that is small enough that it could be impacted by substantial events affecting fisher range.

Lamberson et al. (2000) also conducted an exploratory population viability model and estimated the fisher population to be 100-500 animals.

### **Summary on Abundance**

Current fisher population estimation efforts are based on localized study of fisher home range and minimum density estimates. These estimates are not founded on long-term monitoring data and are not based on extensive data points or comprehensive information collected throughout inhabited fisher range. This is not surprising given the difficulty of using conventional radio telemetry techniques on a wide-ranging, forest dwelling species that inhabits rugged terrain. The estimates vary widely depending on source and suggest there are at least 1,000 to approximately 4,500 fisher statewide. Estimates of density ranged from approximately 15 to 51 fisher per 100 square miles of fisher range as extrapolated from several studies (e.g., Self et al. 2008). Specifically for the southern Sierra Nevada, the population has not yet been specifically monitored to provide actual data, although it is widely estimated to comprise fewer than 500 individuals based on some of the site-specific studies of fisher and their densities/home ranges.

Ultimately, evaluation of change in fisher abundance in California since the 1920s can only be crudely evaluated by comparing statements about declining

trapping numbers and rarity of the animals (Grinnell et al. 1937, Lewis and Zielinski 1996) to our current knowledge about fisher abundance, trapping levels for scientific reasons, and density estimates from the various studies. Based on such information, the Department considers it reasonable to believe that there are at least as many fisher in California now, and likely more, than at the time Grinnell et al. (1937) were “alarmed” about the reduction in trapped fisher in 1924 when licensed trappers reported a total of 34 fisher trapped compared to 102 animals reported taken in 1920.

## **Population Trend**

As there are no empirically-based population data for fisher in northern California, the Sierra Nevada, or statewide, there similarly is no capability to accurately determine population trend. Inferences to trend however, have been made through a variety of analyses based on several site-specific studies or projects and efforts in the southern Sierra Nevada are beginning to provide some preliminary indications of trend.

### **Northern California**

There are no historical population trend estimates of fisher, and no large-scale population trend monitoring is being conducted in northern California at this time. The most intensive field study on fisher population trend and demography is currently being conducted within Hoopa Tribal lands and is discussed in this section.

To help determine population change on their ownership in coastal northwestern California, Green Diamond Resource Company repeated fisher surveys using track plates in 1994, 1995, 2004, and 2006 (Diller et al. 2008). The first three surveys involved the same 40 “segments” (linear routes along which six track plate stations were spaced one km apart), while the 2006 survey consisted of 18 segments randomly selected from the 40 previously surveyed segments. Information on changes in habitat conditions over the study period was not provided. Detection rates at segments increased slightly from 1994 to 2006. At individual stations, detection rates were higher in 1995, lower in 2004, and higher



in 2006. There was insufficient statistical power to detect a trend in these detection ratios (L. Diller, pers. comm.).

## **Fecundity**

Fisher fecundity rates (reproductive rate) in northern California are low and highly variable based on a study that compared reproductive rates in two successive years on the Six Rivers National Forest (Truex et al. 1998). In 1995, 73% (n=11) of captured females were lactating, while only 14% (n=7) of captured females were lactating in 1996. Denning rates in two successive years were also substantially different in interior northwest California (Reno et al. 2008; K. Rulon, pers. comm.). Twenty-two percent (n=9) of monitored females denned in 2006, while 80% (n=10) denned in 2007. In contrast, fisher fecundity on the Hoopa Reservation varied little during a two year study period (Higley and Matthews 2006). Eighty-one to 88% percent of adult female fisher denned during 2005-2006.

Other studies also suggest interannual variability in fecundity is not uncommon. In an introduced fisher population in southern Oregon, 2-4 adult females were monitored each year for seven years (Aubry and Raley 2006). The percentage of females giving birth to kits in a given year varied from 33% (2 years) to 50% (3 years) to 100% (2 years). In Maine, Arthur and Krohn (1991) also found that fecundity varied annually. They followed four adult females in 1985 and 1986, and five females in 1987. None of the females denned in 1985, three (75%) denned in 1986, and three (60%) denned in 1987. Only one of the monitored females denned in both 1986 and 1987.

## **Mortality and survival**

Truex et al. (1998) documented higher female than male mortality rates at three study sites: a) Eastern Klamath in the vicinity of Trinity Lake; b) North Coast near Mad River; and c) Southern Sierra Nevada. Although the authors stated that the higher rate of female mortality at these sites “raises concern”, they primarily expressed that concern for the isolated southern Sierra Nevada population, where female mortality rates were highest. Annual female survival was 72.9% at the Eastern Klamath site and 83.9% at the North Coast site.

Similar rates of female survival have been reported for other studies in California and southern Oregon. However, these estimates should be viewed with caution due to relatively small sample sizes and lack of reported confidence intervals. Annual non-juvenile female survival on the Hoopa Reservation was 72.2% for 18 fishers monitored from January 1 2005 to January 1 2006 (Higley and Matthews 2006). Reno et al. (2008) documented annual female survival at two sites in interior northern California. In the Sacramento River canyon, pooled annual survival was 100% (3 females with known fates in 2006, 2 with known fates in 2007). In the Hayfork Summit area, pooled annual survival was 91.7% (6 females with known fates in both 2006 and 2007). In southern Oregon, average annual survival for female fishers >1 year old was 78% (Aubry and Raley 2006). Studies indicated the ratio of female to male fishers at the Hoopa reservation had declined (Higley and Matthews 2006). Trapping data collected in 2004 and 2006 indicated a change in the fisher sex ratio (from 1M:2.6F, to 1M:1F) since the mid- and late 1990s. Higley and Matthews (2006) speculated that females may be preyed upon disproportionately due to their smaller size. More recent work on Hoopa estimated female annual survival at 75.4% from 2004-2009, although survival did vary across years, ranging from 58.9-94.4% (Higley and Matthews 2006, Higley and Matthews 2009). Lambda was estimated for adults as 1.03 from 2004-2009 indicating a barely stable population within the Hoopa Valley (Higley and Matthews 2009).

## **Density**

The Hoopa Reservation study documented substantial declines in trapping success and estimates of fisher density during one period. Capture success declined from 12% in 1996-1998 (1,324 trap nights yielding 50 individual fishers on 161 capture occasions) to 5.5% from 2004-2006 (1,673 trap nights yielding 20 individual fishers on 92 capture occasions) (Higley and Matthews 2006). In 2005, estimated population density was 0.16 fishers/km<sup>2</sup> (95% CI: 0.16-0.17), while similar estimates were 0.45 (95% CI: 0.35-0.58), 0.37 (95% CI: 0.29-0.46), and 0.29 (0.21-0.38) fishers/km<sup>2</sup> for the years 1997-1999, respectively (Matthews et al. 2006). Researchers at Hoopa speculated that the apparent fisher population decline on the reservation might have resulted from local increases in predation, disease, or the effects of timber management (Higley and Matthews

2006). A large fire (Megram fire) on the east side of the tribal lands may have also been a factor, perhaps displacing predators (e.g., bobcats) onto tribal lands and/or increasing bobcat numbers (M. Higley, pers. comm.).

It had been suggested that the changes in trapping success on the Hoopa Indian Reservation between the mid-1990s and 2006 could be indicative of a localized population decline, but it should not be extrapolated beyond the managed lands of the Hoopa Reservation.

In their final report, Higley and Matthews (2009) reported that the fisher population may have suffered a population decline between 1998-2004 and was reflected in trapping success, but that at the conclusion of the study in 2009, fisher numbers in the area were showing signs of “stability or increase.”

### **Southern Sierra Nevada**

Beginning in 2002, USFS implemented a population monitoring program for fisher in the southern Sierra Nevada. The primary objective of the large scale monitoring effort is to use presence/absence sampling to detect a 20 percent decline in relative abundance with 80% statistical power (Truex et al. 2009) (*note the authors used “decline” rather than “change” which might have been a better word choice*). Preliminary analysis of survey data through 2008 suggested no decline in the index of abundance across the population during the monitoring period.

Spencer et al. (2008) wrote on the predicted rapid population decline and extinction model of Lamberson et al. (2000) that to the contrary: “...the southern Sierra Nevada fisher population has actually persisted, despite its small size and isolation, for many decades, and 2) with no apparent declines in occupancy, and some evidence of expansion, since systematic monitoring was initiated in the mid 1990s (R. Truex and W. Zielinski, pers. comm.).”

## Summary of Population Trend

Due to the lack of historical and current population estimates, it is not possible to ascertain population trends for the fisher in California, nor can expected population trends be modeled adequately due to a lack of demographic data on the population. For northern California, only information for the Hoopa area is available and indicates stable to slightly increasing numbers in the area since 2006 (Higley and Matthews (2009). In the Southern Sierra Nevada, the preliminary analysis suggests no decline in the index of abundance across the population during the monitoring period of 2002-08 (Truex et al. (2009).

Short-term and site specific studies suggest that annual fecundity rates in northern California sub-populations are variable, although similar variation appears typical in other populations. Studies suggest annual female survival in northern California appears to be >70%. The Department's assessment of the available data on fisher fecundity, reproductive potential, mortality and density levels is that: year-to-year variability is high, site/location variability is high, and that there have not been enough samples at a comprehensive scale to demonstrate a trend.

Although the change in sex ratio and lower estimates of fisher density on the Hoopa Reservation was documented and suggested that the Hoopa fisher could have been declining through 2006 there is no compelling reasons to believe these results, could be extrapolated to the larger northern California population. Golightly (2010) (R. Golightly, 2010, App. B) cautioned against using Hoopa results to infer to fisher elsewhere in the range because of differences in habitat. For example, during the period of the reported Hoopa decline, data from Green Diamond lands suggested that fisher abundance did not decline during a similar period. Localized changes in wildlife populations are not necessarily indicative of corresponding changes at the regional or rangewide level, and fisher populations are known to exhibit marked fluctuations (Powell 1994 cited by Powell 2003; Bulmer 1974 and Bullmer 1975 cited by Powell and Zielinski 1994; deVos 1952). While the cause of such fluctuations has generally been ascribed to fluctuating prey densities, changes in other environmental conditions (e.g., increased predator and/or competitor density, disease, habitat change resulting from land management or natural events such as fire, etc.) may also play a role.

## **Factors Affecting the Ability of Fisher to Survive and Reproduce**

### **Threats**

Potential threats to the fisher population are addressed below. The first three (timber harvest that excessively reduces late seral forest and does not retain late seral habitat elements, catastrophic fire, and small population size) are considered more relevant as potential threats at this time. Timber harvest is more widespread in the northern California population, while fire and small population size are more relevant to the southern Sierra Nevada population. Additionally, with new information obtained, disease could possibly be a factor in the Southern Sierra Nevada although uncertainty remains. The remaining potential threat factors are considered secondary as our understanding of their possible implications or significance would be more speculative.

### **Timber Harvest and Forestland Management**

There are many studies illustrating the habitat selection and preferences of fisher for late seral forests and specifically for late seral habitat elements (e.g., previous sections of this report, and several studies referenced in petitioners letter of Aug. 21, 2009). However, there is not substantial empirical evidence to indicate that timber harvesting, availability of denning or resting structures, or the long-term decline in late successional forest acreage is limiting fisher populations in California.

In California, the reduction in late-seral forest habitat due to timber harvest is well documented. In one study of national forests in California, later seral forest had declined from an estimated four million acres in 1900 to 2 million acres by 1985 (Laudenslayer 1985). In the Sierra Nevada, total late successional forest in 1945, when fisher were considered at high risk of extirpation, was estimated at 4.28 million acres, representing 45 percent of the total Sierra Nevada timber cropland (Wieslander and Jensen 1946). In 1993, a comparative study was conducted and only 11 percent of the timber cropland in the Sierra Nevada was identified as late seral, most of which occurred in high elevation forests (Beardsley et al. 1999). Consequently, most of the late seral forest in California forests has been logged since the 19<sup>th</sup> century (Beesley 1996). There is no dispute that there has

been a reduction in acreage of optimal, high quality fisher habitat in California, but that does not necessarily mean that there is not adequate suitable plus optimum fisher habitat remaining now, or planned for the future to sustain populations.

The Department considers the harvest of late successional forest, especially removal of key habitat elements (large conifers and hardwoods with cavities and other structures suitable for resting and denning) to be a potential threat to fisher. Younger stands with high canopy cover may provide suitable foraging and dispersal habitat, and stands with sufficient late seral habitat elements may be suitable resting and denning habitat. Threats to fisher from timber harvest involve the opening of forest canopy, removal of understory vegetation and coarse woody debris, and the removal of important structural components (large trees and snags with cavities for den and rest sites).

Impacts can result from various silvicultural treatments and can occur at various scales. The selective removal of large trees, decadent trees, snags, and large diameter downed logs from managed stands during harvests can reduce available denning and resting sites. Regeneration harvests may remove both overstory and understory vegetation, potentially rendering harvest units unsuitable for fisher reproduction for many years and unsuitable for foraging until relatively dense overhead cover is re-established. Site preparation and plantation management may remove and/or simplify understories, also decreasing foraging and cover value for fishers. However, the potential significance of these impacts is dependent on their size and landscape context. At a landscape scale, the abundance and distribution of fishers is likely to depend on the size and suitability of patches of habitat, and the location of those patches in relation to areas of unsuitable habitat.

Two studies of fisher indicated that habitat modification resulting from timber harvesting resulted in the reduction of fisher density and survival. Truex et al. (1998) reported that fisher in their Eastern Klamath study area had larger home ranges, tended to rest in smaller-diameter trees and logs, and were captured less frequently than fisher in their North Coast study area. The authors concluded that fisher in the Eastern Klamath area appeared to occupy "poorer" quality habitats than those in the North Coast area. The authors hypothesized that

historic patterns of timber harvesting created the poorer habitat conditions in the interior portions of northwestern California relative to conditions nearer the coast, they also recognized that differences in climate and forest productivity between the study areas may have affected habitat quality. Thus, fisher were found to occupy both higher quality as well as lower quality habitats, as affected by timber harvesting, in northern California.

The second study, Buck et al. (1994) indicated that logging resulted in habitat loss that has affected the fisher population in northern California. Buck et al. (1994) compared fisher habitat use of “lightly” and “heavily harvested” areas. Within the lightly harvested areas, fisher used habitats in proportion to their availability. Within the heavily harvested area, fisher used habitat types with overhead canopy more frequently than expected based on availability. Greater numbers of fisher mortalities documented during the study occurred within the heavily harvested area. All fishers that died during the study were found in either clearcuts, areas without overhead canopy, or hardwood-dominated stands. The authors concluded that the more intense harvesting reduced habitat quality more compared to the lightly harvested area. Other studies have shown that fisher tend to avoid some managed areas (e.g., recent clearcuts) (Kelly 1977; Weir and Harestad 1997; Simpson Resource Company 2003), but the extent to which avoidance of more open canopy areas within home ranges adversely affects fisher fitness is unknown.

Cause-and-effect manipulative experiments of land use effects on the fitness of wide-ranging animals such as the fisher are difficult to conduct and costly to implement because of the scale needed and lack of control of environmental variability. While harvesting can adversely affect components of fisher habitat at various scales (harvest unit, stand, patch, and element), the extent to which the above and other studies demonstrate that harvesting has adversely affected fisher populations or rendered large areas of habitat (e.g., the size of average fisher home ranges) unsuitable in northern California is unknown. Fisher inhabit these lands managed primarily for timber production, including industrial timberlands that have extensive harvest histories. Other managed timberlands are apparently not currently occupied by fisher (e.g., Self et al. 2008) or have not been recolonized by fisher since the significant reductions in fisher populations decades ago. Additional information on timber harvest effects on fishers will be

forthcoming in the future as the US Forest Service carries out forest thinning and burning projects in the southern Sierra Nevada (Spencer et al. 2008), and as the Department and others study the movements and survival of recently translocated fishers.

The Department is aware that fisher studies in the past two decades or more have documented the continued presence and reproduction of fisher on managed timberlands. That fishers inhabit managed forests indicates that suitable habitat elements are present at levels adequate to sustain the animals.

In general, private Industrial and private non-industrial timber lands have 40 percent fewer snags of all size and decay classes than are found on National Forest reserve lands (3.7 per acre versus 6.2 per acre). The relative abundance of large snags across ownerships and management emphasis is also noteworthy. Private Industrial and Private Non-Industrial ownerships have 70 (0.3 snags per acre) and 80 (0.2 snags per acre) percent fewer snags of greater than 30 in dbh, respectively, than do National Forest reserve lands (CALFIRE 2003).

#### Forest Management and fisher distribution in the Sierra Nevada

The cause of the gap in the Sierra Nevada is unknown and the reasons for fisher not recolonizing the central and northern Sierra Nevada have not been determined. It has been hypothesized however, that the current gap where fisher are rare or extirpated in the central and northern Sierra Nevada is partly due to existing conditions on the forests of the Sierra Nevada in terms of their structure and lack of necessary elements. The hypothesis is that fisher have not recolonized because the habitat is unsuitable as a result of the long history of logging combined with the more recent history of fire suppression.

Bias and Gutierrez (1992) and Beardsley (1999) indicated late seral forests are generally lacking in the central Sierra Nevada and that less than 9 percent of the private timberlands possessed a mean dbh greater than 21 inches. The percentage of the land base that is private timberland increases substantially transitioning north from the Merced River which is generally considered the line separating occupied habitat from the area not currently occupied. The size of



timber harvest plans in the Sierra Nevada compared to North Coast plans, is substantial. North coast plans on industrial timberlands typically average less than 100 acres compared to Sierra Nevada plans that are often more than ten times larger, and can be as much as 2,500 acres. These larger Sierra Nevada plans have the potential to impact more streams, disturb more ground, and affect wildlife over larger areas. Whether these larger scale disturbances in the Sierra Nevada preclude fisher from recolonizing historical range is partially being assessed with the current translocation project.

### **Catastrophic Forest Fire**

Wildfires are a natural part of California's forests and most frequently start as a result of lightning strikes. Low intensity forest fires are considered to have a beneficial effect on fisher habitat and on their prey populations. There is a distinction however, between catastrophic fires and the low intensity fires that were a natural part of the landscape prior to European settlement. Catastrophic, or stand-replacing, wildfires burn at high intensity over large areas killing trees and destroying existing forest stands. Because fisher are dependent on late seral forest structures for resting and denning, the loss of these elements would be expected to negatively affect habitat quality, particularly because the successional sequence of forest development to have large-diameter trees generally may require 200 or more years of growth before they reach an old-forest condition (Van Pelt *in* Lutz et al. 2009).

Along with the reduction of old growth/late seral forests from timber harvesting came the implementation of fire suppression in California. By the early 1900s, fire exclusion in the Sierra Nevada had become a general policy among government agencies (Husari and McKelvey 1996), and had begun to change forest species composition and structure. North et al. (2007, 2009) suggested retaining intermediate-sized pines and hardwoods during thinning operations in mixed conifer Sierra Nevada forests due to their relative scarcity as influenced by this policy.

Historical fire suppression further changed forest structure in the Sierra Nevada by causing an increase in fire return interval. Sierran mixed conifer fire regimes

prior to the 1860s were characterized by frequent, low intensity fires with a median fire return interval (FRI) of consistently less than 25 years (Skinner and Chang 1996). Some estimates of historical Sierran mixed conifer FRI are considerably lower, ranging from 12-17 years (McKelvey et al. 1996, North et al. 2005). However, current FRIs differ from historical FRIs by 1-2 orders of magnitude. Recent estimates of current Sierra mixed conifer FRIs are between 185-644 years (Skinner and Chang 1996, McKelvey and Busse 1996, McKelvey et al. 1996).

With the increased fire return interval, fires in the Sierra Nevada have increased in severity, intensity, and spatial extent by the late 20<sup>th</sup> century (Skinner and Chang 1996, Lutz et al. 2009). These more intense fires are capable of causing dramatic habitat change in forests where low intensity fires were frequent in the past (Weatherspoon et al. 1992), such as mixed conifer forest of the Sierra Nevada. Crown fires, characteristic of high intensity fires, are capable of destroying forest canopy and forest elements such as snags. Crown fires have become frequent in the Sierra Nevada compared to the pre-fire suppression era (McKelvey et al. 1996) in which early surveyors reported fires typically of surface nature with crown fires apparently uncommon (Sudworth 1900: 557-558).

Catastrophic fires have become increasingly common in recent decades due to the unnatural accumulation of forest fuels resulting from decades of fire suppression (Weatherspoon et al. 1992). Fire suppression activities still occur in California due to the unnatural accumulation of forest fuels; if left unchecked, some fires can cause catastrophic fires and destroy homes and other infrastructure. Natural fires, controlled burns (some of which escape control), and unintended human-caused fires remain a significant factor affecting the forest landscape, and fishers are then subject to habitat change already exacerbated by timber harvest and subsequent forest fragmentation. Figure 11 displays the extent of fires in California since 1950 (CALFIRE 2003), many in areas that fisher inhabit today. What is unknown is whether, or when, the southern Sierra Nevada will experience its next large fire in the approximately 2.6 million acre predicted range of the fisher, or whether the fuel reduction efforts currently being initiated will successfully ensure protection of fisher habitat at a large scale.

The largest fires recorded in the Sierra Nevada were the McNally (2002) and Stanislaus (1987) fires at approximately 150,000 acres each (CALFIRE records, [http://www.fire.ca.gov/communications/downloads/fact\\_sheets/20LACRES.pdf](http://www.fire.ca.gov/communications/downloads/fact_sheets/20LACRES.pdf)). Both fires surely burned both suitable as well as unsuitable habitat for fisher, but whether they negatively affected the population is unknown.

Catastrophic wildfire would be expected to impact fisher populations through a variety of pathways, including: direct mortality to fishers, destruction of habitat, direct mortality to and short-term population depression of prey species, and isolation and fragmentation of suitable fisher habitat (Green et al. 2008). The destruction and isolation of fisher habitat from wildfire is expected to synergistically interact with the problems of low population size and low genetic variability to increase the risk to fisher in the southern Sierra Nevada (Spencer et al. 2008).

Green et al. (2008) suggested the following as risk factors regarding the effects of catastrophic fire on fisher:

- The largest (disturbance) events affecting fishers in the southern Sierra and their potential to sustain a viable population appear to be large, stand-replacing wildfires.
- Past large wildfires in the Stanislaus National Forest have created large patches of unsuitable habitat that are functioning as a barrier to northward expansion of southern Sierra fisher populations.
- There is an increasing trend in the annual amount of area burned by wildfires in the last 30 years and the trend is likely to continue into the future in the absence of vegetation and fuels management activities (USDA 2004).
- Fire suppression efforts can impact fishers through fire break construction, back-fires, and the influx of firefighters and equipment into remote habitats.

The threat of wildfire to fisher also applies to the occupied range in northwestern California with the possible exception of the near-coastal redwood zone. For example, Courtney et al. (2004) in discussing threats to the northern spotted owl state that catastrophic wildfire is currently the primary source of habitat loss to

that species and that the Klamath province is particularly vulnerable to catastrophic wildfire. Although there is uncertainty whether recent fire patterns in the relatively remote Klamath region are outside the natural range of variability (Frost and Sweeney 2000), recent compilations of fire data for the North Coast Ranges (Stuart and Stephens 2006), Klamath Mountains (Skinner et al. 2006), and Southern Cascades (Skinner and Taylor 2006) suggest higher fuel loads and increasing areas of high intensity fires have resulted from decades of fire suppression in these areas. Extensive timber management has created forests more prone to high severity fires in these regions (Frost and Sweeney 2000, Stuart and Stephens 2006). Together, these conditions suggest some risk to fishers in the northern California population from catastrophic wildfire.

The Conservation Biology Institute recommended that in the absence of fuel reduction projects, catastrophic wildfire could put the fisher at risk of extirpation in the southern Sierra Nevada (Conservation Biology Institute, pers. comm., 2008; Spencer et al. 2008). Wildfires are expected to become more frequent and larger in the future (Syphard et al. 2007b). Additionally, as residential development and recreation continues to expand in rural California human-caused wildfire ignitions can be expected to become more frequent (Syphard et al. 2007a). The southern Sierra Nevada fisher population is potentially vulnerable to habitat isolation within its population if a large wildfire occurred and bisected their range because of the narrow linear arrangement of suitable habitat along the west slope of the range.

The Department considers wildfire a potential threat to fisher and their habitat, more so in the southern Sierra Nevada, and believes ameliorating fire risk deserves the significant management consideration being given to it by the US Forest Service. The recent, severe wildfire years in other parts of California, combined with the current efforts to address and adapt to drought conditions and possible effects of climate change have brought wildfire to the forefront in wildland management concerns. The uncertainty however, of when, where, and how large a fire may, or will occur, makes it challenging to plan responses, contingencies, or management strategies in advance; just as it makes it difficult to know with certainty what the level of impact the future fire regime will have on the fisher population. Nevertheless, should catastrophic scale wildfire(s) occur in the southern Sierra Nevada fisher range, there seems little question that it could impact the population.

## **Population Size and Isolation**

The Southern Sierra Nevada fisher population is separated from the northern California population, and from fisher populations in British Columbia and other parts of North America (Zielinski et al. 1995, Aubry and Lewis 2002). This isolation precludes genetic interchange, increasing the vulnerability of the northern California population. Aubry and Lewis (2002) stated: "...the inability of extant fisher populations to support one another demographically, including those that are isolated by relatively small distances...or to colonize currently unoccupied areas within their historical range, are significant conservation concerns".

Drew et al. (2003) concluded that California fisher populations have become isolated from fishers in British Columbia and the Rocky Mountains due to extirpation of fishers in Oregon and Washington, and that one haplotype detected in historical California specimens appears to have been lost from current populations. The authors speculated that this haplotype was likely lost "because of genetic drift and a lack of gene flow." Although genetic isolation may permit populations to adapt to local conditions, Drew et al. (2003) concluded the risks of continued isolation, including susceptibility to catastrophic events, were greater than the potential benefits of local adaptation.

High levels of genetic structure between Pacific coast fisher populations and decreasing genetic diversity within populations distributed from north to south were noted by Wisely et al. (2004). Heterozygosity and allelic richness were greater in south-central British Columbia (considered to be part of the core of the fisher's distribution) than in California populations. Wisely et al. (2004) sampled four nominal subpopulations in California: two from the northwestern California population ("Klamath-Siskiyou" and "California Coast Range") and two from the southern Sierra Nevada ("Southern Sierra – North" and "Southern Sierra – South"). Overall, heterozygosity was relatively low in the California populations, but somewhat higher in the Klamath-Siskiyou and California Coast Range populations than in southern Sierra populations. Allelic richness was slightly higher in northwestern California compared to the southern Sierra Nevada. Wisely et al. (2004) found statistically significant genetic distances between all

four California subpopulations, though genetic distance between the Klamath-Siskiyou and California Coast Range populations was the lowest in the state.

Wisely et al. (2004) mentioned several potential adverse ramifications of population isolation and reduced gene flow (such as inbreeding depression, reduced ability to adapt to changing environments, increased vulnerability to stochastic demographic events and environmental changes) and suggested that “immediate conservation action might be needed...” for Pacific coast fisher populations. However, the authors did not provide specific thresholds or guidance for determining when such action would be necessary.

Wisely et al. (2004) stated that the low genetic diversity and high genetic structure of southern Sierra populations suggested that they are “vulnerable to extinction”. In contrast, northern California fisher populations have slightly elevated genetic diversity and exhibit less genetic structure. These characteristics, in combination with larger population sizes, suggest that the potential threats faced by fishers in the northern populations related to size and isolation are likely not as acute as those faced by the southern Sierra population (S. Wisely, pers. comm.; C. Carroll, pers. comm.). Additional studies are needed to determine the size, distribution, and trend of the northern California population. Because genetic diversity is lower than that found within British Columbia populations, continued study and monitoring of the northern California population is warranted.

The Department is aware of only one study that has directly addressed the viability of the fisher population in northern California. Powell and Zielinski (2005) used the population matrix modeling software VORTEX to evaluate the population and to investigate the potential effects of removing animals from that population. The authors cautioned the model’s output is an index of population viability for the purpose of investigating possible effects of translocation projects, not a dependable estimate of the probability of extinction of the population. Assuming an initial population size of 1000 fishers in northwestern California and a carrying capacity of 2000 ( $\pm 250$ ) animals, the authors modeled a 5 percent probability of extinction over the 100 year modeling period. Halving the initial population size increased the probability of extinction by 1 percent. The authors also estimated that the removal of 20 fishers per year (five fishers from each of

four different subpopulations) for 8 years would increase the probability of extinction less than 5 percent and would not jeopardize the population.

The model used by Powell and Zielinski (2005) rests on various assumptions about the population and environmental conditions, and the authors expressed concern about their assumptions regarding the effects of timber harvest, the rate of timber harvest, fisher vital rates, and the sex ratio of adult fishers. In particular, they stated the difficulty of building multi-year effects of timber harvesting activities on fisher subpopulations into the model “may lead to somewhat optimistic forecasts on the viability of the northwestern California population”. This caveat is important, because to the best of our knowledge, there are no published studies on the effects of timber harvest, and its rate, on fisher vital rates. Additionally, the analysis was conducted without considering information that suggested that fisher, particularly females, may be declining on Hoopa Tribal lands. Powell and Zielinski (2005) noted the model would have to be revised, by varying the adult sex ratio to account for such a potential scenario.

As noted earlier, the population size of fishers in the southern Sierra Nevada is considered low. Because the population is isolated, it is more at risk of extirpation by a variety of stochastic influences (Spencer et al. 2008). Examples of stochastic events include successive years of drought that deplete prey populations for fisher, and/or one or more catastrophic fires in a short time frame.

There is also the potential for the accumulation of deleterious mutations to negatively affect population growth, and mutation accumulation and extinction time are highly sensitive to habitat fragmentation. There is a critical level of habitat connectivity that must be maintained for efficient selection against deleterious mutations. Because the interaction between mutation accumulation and metapopulation demography is synergistic, an assessment of metapopulation viability based only on demographic forces is especially likely to underestimate the risk of extinction (Higgins and Lynch 2001).

## **Roads**

The Department examined road density in this review by displaying various

levels of roadways in fisher range, from Interstates to unpaved USFS roads (Figure 8). Of management and conservation interest, this figure shows fewer roads in northwestern California, Mendocino National Forest/Yolla Bolly Wilderness, and the southern Sierra Nevada, all areas fisher inhabit today.

Vehicular collision is a recognized source of fisher mortality (Truex et al. 1998, Sweitzer and Barrett 2009), and is probably second to trapping as a source of non-natural death in the North American range of fishers. For example, approximately 3.4 percent of 147 radio-collared fishers studied in Massachusetts (York 1996) and Maine (Krohn et al. 1994) were killed by vehicles. Past and ongoing studies in the southern Sierra Nevada have also documented road kill as a mortality factor (Truex et al. 1998, R. Barrett, 2010, App. B). Road-kills at the northern extent of the Sierra Nevada fisher population (around the Merced River and Yosemite National Park area) are particularly of interest as they are possibly detrimental to fisher dispersal movements to the north and could thereby hinder the potential for population expansion northward. Fisher that are not radio-marked and under study get killed by road traffic, particularly on Highway 41 leading into Yosemite National Park from the south. In 2009, 2 dead fisher were collected on Hwy 41 (S. Stock, pers. comm.).

Presumably, the risk of collision mortality increases with the density of highways and freeways where vehicle speeds are highest and the ability of driver or fishers to avoid a collision is lessened. This may be a factor in the Sierra Nevada where many highways and Interstate-80 intersect current and former fisher habitat, with an average of only about 50 km separating each. Consequently, dispersing fishers might not be able to avoid crossing highways and encountering the associated hazards therein. Another threat to fisher from roads is if they inhibit movement by fisher. This could be the case with major highways such as Interstate 80, and highways 4, 49, 50, and 88 were fisher to inhabit this region and would need to be addressed in any translocation planning into the area. The importance of roads to fisher in the Sierra Nevada has not been quantified, but highways in particular have the potential of being a threat.



## Predation

The role of predation as a mortality factor for fisher population dynamics is unknown. Predation is a normal part of interspecific interaction of fisher with other predators (primarily the bobcat, coyote, and mountain lion in California) and will be a source of mortality. As yet, there are no studies of how land management activities such as timber harvesting, grazing, hunting, or development affect the interactions of predators that could be a threat to fisher. In the southern Sierra Nevada, the Sierra Nevada Adaptive Management Project (SNAMP) study identified predation as most common source of mortality. From January 2008 - October 2009, 46 percent (10 of 22) of fisher mortalities were concluded to be a result of predation. Though these are preliminary results, bobcats and mountain lions (*Puma concolor*) were identified as key predators (SNAMP U.C. Science Team Annual Report, 2009). Also in the southern Sierra Nevada, the Kings River fisher project identified predation as the most common source of mortality. From 2007-2009, 81 percent (13 of 16) of fisher deaths were the result of predation. Predators definitively identified to date include mountain lion (2), bobcat (1), and coyote (*Canis latrans*) (1) (Purcell et al. 2009).

Predation is also an important source of mortality on the Hoopa Valley Reservation in northern California. From 2004-2009, 73 percent (16 of 22) of mortalities occurred as a result of predation although during this period, the fisher population remained stable to slightly increasing. Bobcats, mountain lions, and unknown canids (possibly coyotes) were identified as predators (Higley and Matthews 2009). During a 1996-1998 study in Hoopa, 4 out of 5 fisher skulls recovered were found with puncture wounds suggestive of bobcat predation (Higley et al. 1998).

All three of the studies cited above are ongoing and as the collective sample size increases, a more definitive assessment of the role of predation as a factor affecting fisher populations will likely emerge. The Department is currently providing some funding for continued work to help determine predators of fisher in California, and to understand bobcat home range patterns where they co-occur with fisher.

Previous studies on fisher in California also documented predation rates (Buck et

al. 1994, Truex et al. 1998). The fisher, especially females, due to their smaller body size and smaller home ranges, may be more susceptible to predation in areas with fragmented forest stands, and sub-optimal forest cover; thus, certain timber harvest practices (e.g., clearcuts) and patterns may expose them to additional predation risk (Buck et al. 1994:373-374). In California, bobcats and coyotes occupy more than one habitat type and have a broader statewide distribution than fisher. Bobcats and coyotes are considered habitat generalists whereas the fisher is a forest specialist (Buskirk and Zielinski 2003). Bobcats and coyotes are larger than fishers and may kill them for food, or simply to exclude them from their own home ranges in order to reduce competition for food. Scheffer (1995) noted: In Washington state, the Makah natives say that the fisher is occasionally attacked by the bobcat (Gunther *in* Scheffer 1995:90-91). Grinnell et al. (1937:227) noted the mountain lion as the only predator on fisher known to them, described by J.C. Howe via a trapper on the Upper Kern River.

The carnivore community in California forests has undoubtedly been altered from the pre-European settlement condition due to habitat changes caused by timber harvest, forest fragmentation, and fire suppression. These changes, in addition to bounty hunting, over-trapping, and poisoning campaigns, modified the carnivore community. The changes have occurred on the landscape with varying intensity over space and time and the cumulative effects on fisher populations are unknown. Studies are needed on known predators/competitors of fishers, and how their movements, densities, and habitat relationships overlap. Bobcats in particular have been poorly studied in western forest environments (G. Wengert, pers. comm.), and intensive camera work in fisher habitat in the southern Sierra Nevada has revealed bobcat presence across the landscape, as one would expect with a generalist predator (R. Sweitzer, pers. comm), but they have also been detected in habitat used by fisher and may compete with or prey on fisher.

## **Disease**

Green et al. (2008) summarized the following: Fishers, like all mesocarnivores, are susceptible to a number of diseases and parasites. Diseases include rabies, plague, canine and feline distemper, toxoplasmosis, leptospirosis, trichinosis,

and Aleutian disease (Strickland et al. 1982, Wild and Roessler 2004). Banci (1989) noted fisher susceptibility to sarcoptic mange. Common endoparasites include nematodes, cestodes, and trematodes, and ectoparasites fleas, ticks, and mites (see Powell [1993] for an extensive list of known parasites). However, none of these diseases or parasites had been thought to constitute a significant source of mortality (Lewis and Hayes 2004), possibly because of a weak transmission pathway due to the solitary nature of fishers (Coulter 1966, Powell 1977), and tendency to avoid proximity to other individuals (Powell 1977, Arthur et al. 1989a).

In northern California on the Hoopa Valley Indian Reservation from 2004-2007, 76 percent (60/79) had been exposed to *Anaplasma phagocytophilum*, 58 percent (45/77) had been exposed to *Toxoplasma gondii*, 31 percent (28/90) of fishers had been exposed to canine parvovirus (CPV), 24 percent (24/102) had been exposed to *Borrelia burgdorferi* sensu lato (bacteria that causes lyme disease), and five percent (5/98) had been exposed to canine distemper virus (CDV) (Brown et al. 2008).

Current monitoring of fishers for pathogenic exposures and infections in the southern Sierra Nevada has shown exposure and active infection to parvoviruses as well as distemper viruses. In addition to these two viruses, many fishers in these areas have shown exposure to the protozoan, *Toxoplasma gondii*, which has been documented to cause morbidity and mortality in other mustelids. Recent necropsy findings have documented 27 percent (5 of 18) fisher mortalities from the UC Berkeley/SNAMP project, and 13 percent (1 of 8) mortalities from the USFS Kings River project to be disease related. Other mortalities in the southern Sierra Nevada have included rodenticide poisoning, starvation, vehicular strikes, as well as predation. Additional investigation is planned because preliminary findings indicate that pathogenic exposure could predispose individuals to a higher risk of vehicular strikes or predation (M. Gabriel, pers. comm.).

In the southern Sierra Nevada, new information from the Sierra Nevada Adaptive Management Project (SNAMP) study identified 58 percent (15/26) of fishers exposed to *Toxoplasma gondii*, four percent (1/24) exposed to CPV, and a low occurrence of CDV (Sweitzer and Barrett 2009). Also in the southern Sierra

Nevada, the Kings River Project identified 6 percent (2/31) of fishers exposed to CDV, 44 percent (8/18) exposed to CPV and 11 percent (2/18) exposed to *Toxoplasma gondii*. In addition, one active infection was documented of CPV (Purcell et al. 2009).

Brown et al. (2008) cautions that although little is known about diseases in fishers, many of the pathogens evaluated are known to cause morbidity or mortality in susceptible carnivores, specifically through immunosuppression and synergistic effects of pathogen exposures. The Department would expect disease transmission and outbreaks to be most likely where urban development occurs in or near fisher habitat.

As it relates to translocation of fisher, the Department has received input concerned about moving fisher into an extirpated area and them coming into contact with extant animals but believes that risk is manageable with the Department's wildlife veterinary expertise and thorough disease investigation on translocation animals. A rigorous protocol for handling, testing, and release of animals for translocation is in place.

### **Urban Development**

The California Department of Forestry and Fire Protection (CALFIRE) estimated that between 2000 and 2040, 343,000 acres of undeveloped California conifer forests will be impacted by residential development (or six percent of the year 2000 undeveloped California conifer forests) along with an additional 17,000 acres (four percent) of conifer woodland (CALFIRE 2003). The human population growth rate in the Sierra Nevada is expected to continue to exceed the state average (California Department of Fish and Game 2007).

Development pressure in the range of fisher is noted to be high in the foothill areas adjacent to metropolitan areas such as Redding, Sacramento, Stockton, Merced, Fresno, and Bakersfield (California Department of Fish and Game 2007). Increased residential development, particularly ranchette-type (low density) has been noted extending out from Redding into the Sierra Nevada and Cascades along major highway corridors (California Department of Fish and Game 2007).

Residential development is not evenly distributed through fisher habitat. Private property, and thus development pressure is concentrated in the oak woodland and low elevation (approx. below 3,000 feet) conifer zone on the western slope of the Sierra Nevada (California Department of Fish and Game 2007).

Developments include year-round residences, vacation residences, resorts, golf courses, and commercial developments

In the central Sierra Nevada, residential development along two national forest boundaries, the Tahoe and Stanislaus, has been identified as being the source of future increased risk of wildfire and invasive species; impacts to water quality; overuse from recreationalists; increased trash and traffic; disruption of natural processes and disturbance to wildlife (Stein et al. 2007). Duane (1996) identified at least five ways development is known to negatively impact wildlife (and potentially the fisher):

1. Reduced total habitat area through direct habitat conversion.
2. Reduced habitat patch size and increased habitat fragmentation.
3. Isolation of habitat patches by roads, structures, and fences.
4. Harassment of wildlife by domestic dogs and cats.
5. Biological pollution from genes of non-native plant species.

To this list the Department would add the following:

6. Increased disease exposure risk from domestic animals (Brown et al. 2008, Gabriel et al. 2008).
7. Direct mortality from vehicles (USDI 2004).
8. Disruption of normal behavior from human presence; disturbance during critical periods of the fisher's life cycle (e.g., the denning period for females with kits) would be most critical impact.
9. Blockage of, or interference with migration and dispersal (California Department of Fish and Game (2007)).
10. Increased frequency of wildfires and associated impacts (Syphard et al. 2007, Syphard et al. 2007a)

The potential effects of residential development on fisher extend beyond the physical footprint of the structures. Urban development should be considered a

threat to the fisher. In their 12-month finding on the petition for federal-listing of the fisher, the USFWS found that development effects and associated habitat fragmentation resulting from roads has possibly had a role in the loss of fisher from the central and northern Sierra Nevada and in the species' failure to recolonize those areas (USDI 2004). Additionally, the effects of urban development (e.g. fragmentation, disease exposure, fire threat, habitat loss) could potentially compound the threats to the species related to low population size.

## **Recreation**

Recreation activities occurring in fisher habitat are abundant although the Department is unaware of any studies of recreational impact on fisher. In the central Sierra Nevada, the Department has commented on proposed recreational projects on the Stanislaus, El Dorado, and Toiyabe National Forests. Department concerns focused on recreational activities in winter and other times of the year, when denning, hibernating and other essential behaviors would be disrupted. Impacts may also result from winter recreation in the vicinity of the winter range and fawning areas where fisher are believed to feed on carrion.

Recreational activities of greatest concern are motorized activities including snowmobiles in the winter, ORV's, dirt bikes, ATVs during the remainder of the year, and noise from all of the above. Potentially, direct impacts to species could occur from killing animals. Indirect impacts could cause fisher to move to less desirable habitats where they might be more vulnerable to predation or starvation, pollution/contamination of important habitats, and erosion and degradation to aquatic habitats. The Department is unable to conclude whether existing or planned recreational uses on lands inhabited by fisher do, or will have, a significant effect. There is no evidence that these activities have been detrimental at this time. The Department's concerns would apply to the fisher in the central Sierra Nevada on public lands. Recreational activities on private lands is considered minimal. As previously stated, the central Sierra Nevada is not currently occupied by fisher, recreational impacts should be addressed if translocations are planned.

## Poaching and Incidental Capture

As it relates to historical legal take, fishers are relatively easy to trap and their pelts have historically been valuable (Rand 1944, Lewis and Zielinski 1996). The first regulated trapping season occurred in 1917, and the license cost was \$1.00 (Figure 12), (CA Fish & Game 1917). By 1925, trapping had been identified as a threat to fisher populations in California (Dixon 1925). The number of fisher reported trapped in California for the 1917-18 year by nearly 4,000 licensed trappers was 28 animals (Calif. Fish and Game 1919). Licensed trappers reported taking 229 fishers in California between 1920 and 1924, and during that period the price of a fisher pelt was much higher than that of any other furbearer in the state (Figure 13) (Grinnell et al. 1937). Dixon (1925) proposed a three year closed trapping season to benefit fishers, and Grinnell et al. (1937) suggested “much needed, prolonged closed season”. In 1946, fisher trapping in California became illegal (Lewis and Zielinski 1996).

Fishers are known to be incidentally captured in traps set for other furbearers (Lewis and Zielinski 1996). Between 1946 and 1998, fishers captured in this fashion may have been injured or killed when captured in body-gripping traps. In 1998, body-gripping traps (including snares and leg-hold traps) were banned in California for commercial and recreational trappers (Fish and Game Code § 3003.1). Licensed individuals trapping for purposes of commercial fur or recreation in California are now limited to the use of live-traps. Fishers captured in live traps (cage traps) are apparently infrequently injured (Department of Fish and Game, unpublished data on file at Redding office), and owners of traps or their designee are required by regulation to visit all traps at least once a day.

Fishers will scratch at the bottom of live traps, and grip the cage bars/wires with their teeth; such behavior has been observed in captive and wild-caught fishers and could potentially result in broken canines or other teeth, or injured feet (R. Golightly, pers. comm.). If such injuries lead to infection or reduced ability to capture prey or escape predators, fisher survival in the wild could be compromised.

Researchers live-trapping fishers for scientific studies are required by the Department to install a wooden “cubby” box onto the cage trap to provide thermal

and visual cover for trapped animals (Fowler and Golightly 1994). Fisher incidentally trapped by a commercial or recreational trapper in a cage trap without the cubby box modification would have a higher probability of injury, or death due to hypothermia, but the level of risk to fishers from this threat has not been studied and is unknown.

The Department does not require that incidental captures be reported by licensed commercial or recreational trappers, but some trappers occasionally provide such information and we have information on incidental fisher catch and release from Trinity and Shasta counties.

Licensed nuisance/pest control operators can use body-gripping traps (conibear and snare) in California. Where such operations occur in fisher range, incidental capture and take could occur. However, use of body-gripping traps is restricted throughout the range of the Sierra Nevada red fox (*Vulpes vulpes necator*), thus, any incidental capture or take would be limited to northwestern and north coastal California, including the Mendocino National Forest area, outside of the range of Sierra Nevada red fox. The only information the Department has on incidental capture of the fisher is from the USDA Wildlife Services who indicated “we have no record of any non-target fisher captures in our system which dates back to the early 90s” (C. Coolahan, USDA, pers. comm 2010).

The sale of trapping licenses in California has declined since the 1970s and 1980s (Figure 12), indicating a decline in the number of traps in the field during the trapping season for other furbearers. However, the number of trapping licenses sold has recently increased, likely due to the high pelt price for bobcats (*Lynx rufus*), based upon data from the 2002-03 (139 sold) through 2008-09 (432 sold) license years (pers. comm. J. Garcia). Data from 2009-10 are not yet available.

Some fisher poaching is likely to occur (Lewis and Zielinski 1996, Truex et al. 1998). Additionally, hunters using hounds for legal game could occasionally tree fishers, but the fate of such fishers is unknown. The Department has no information to suggest poaching is a widespread practice or a threat to fisher populations.



## Climate Change

Global climate change is predicted to have significant effects on species and habitats resulting in altered precipitation patterns leading to vegetation change. For the fisher, vegetation changes may lead to changes in type and availability of prey, availability of den and rest sites, canopy cover, and altered microclimates. California fisher populations may be faced with challenges or benefits stemming from a changing climate in the coming years. Climatic projections for the next 90-100 years suggest that annual mean temperature in California will increase and spring snow pack in the Sierra Nevada will decrease (Cayan et al. 2006). Predictions of mean annual precipitation are unclear; collectively, the results of several models suggest relatively little change except that more precipitation may occur in winter as rain rather than snow, a trend that will increase with increasing winter temperatures (Cayan et al. 2006, Safford 2006). Yeh and Wensel (2000) found that for the mixed conifer forest of northern California, conifer tree growth declined with decreases in winter precipitation and increases in summer temperature.

Other threats to fisher may be exacerbated by climate change, e.g., wildfire may increase in size, intensity, duration, and frequency. Fried et al. (2006) predicted that subtle shifts in fire behavior, of the sort that might be induced by climate change anticipated for the next century, are of sufficient magnitude to generate an appreciable increase in the number of large wildfires.

In forest ecosystems, disturbance such as insect disease and drought are expected to rise, and forest productivity is projected to increase or decrease depending on species and region (Cayan et al. 2006, Lenihan et al. 2006). Models suggest that the extent of mixed evergreen forest (e.g., ponderosa pine/black oak forest, Douglas-fir/tanoak forest, tanoak/madrone/oak forest) will increase, while evergreen conifer forest (e.g., mixed conifer forest, ponderosa pine forest) may decline (Lenihan et al. 2003, 2006). Increased fire frequencies may benefit hardwoods, as many California hardwoods resprout after fire and subsequently encounter reduced competition if neighboring conifers are killed during fire events.

Other threats that may be exacerbated by climate change are: invasive plant

species may find advantages over native species in competition for soils, water, favorable growing locations, pollinators, etc. Changes in forest vegetation due to invasive plant species may impact wildlife by corresponding changes to their prey species, both in type and number. The timing and duration of modified patterns in recreational activities by humans may have an effect on fisher by disturbing den or rest sites. Exposure to new diseases or increased susceptibility to disease may result from being stressed by inhospitable temperatures, unavailability or exhaustive searches for mates, water, prey, dens, and rest sites.

The effects of these potential changes on wildlife including the fisher are unknown. The interplay of increased ambient temperatures with fisher physiology may render specific sites more or less suitable relative to current conditions (Safford 2006). Decreased snowpack may increase the suitability of certain areas, though adequate canopy cover and den sites would still be needed. Lack of deep snow in winter may allow fisher to occupy sites that would otherwise be inaccessible. Fisher may benefit from the increased abundance of hardwoods in montane forests as they often provide important denning and resting structures. However, if wildfire becomes more frequent or severe, important habitat features such as canopy cover, density of large or decadent trees, and abundance of surface woody debris may decline (McKenzie et al. 2004, Safford 2006). Tree health, and by extension, forest health and habitat conditions will likely be further compromised from increased susceptibility to disease and insect infestation. Such changes may adversely affect fisher. However, at least in the short term, some of these changes may improve conditions for fisher prey which primarily use early-seral habitats (e.g., *Spermophilus beecheyi*, *Thomomys bottae*, *Sylvilagus* spp., *Lepus* spp.) (McKenzie et al. 2004).

Restoring or growing/recruiting fisher habitat may be affected by potentially reducing the volume growth and timber yield of species like ponderosa pine and Douglas fir. Timber companies may, in response to lower growth and yields increase harvest levels, shorten rotations, or reduce monetary investments in maintaining a healthy forest (Battle et al. 2006). Changing the species composition and tree density are also actions that would, from an economic perspective, hedge against sustaining losses due to climate change. It is possible that climate change could affect the recolonization of historic range by fisher.

The short and long term impacts to fisher from climate change will be both direct and indirect. Assumptions of benefits to fisher prey species from forests reverting to early seral stages as a result of drought, disease, and wildfire rely on static ecosystems processes. Many climate change researcher are documenting changes in species composition following elevational and latitudinal gradients, and conclude ecosystem function may change as a result of changed floral and faunal species composition (Thorne et al 2009, Forister et al 2010, Moritz et al 2008). Rodents and hares are also susceptible to parasites and disease that are predicted to become more prevalent in wildlife populations in a changing climate (Harvell et al 2002, Daszak et al 2001). Redistribution of species and habitats may create new competitive interactions and predator-prey relationships that will further diminish the assumptions of circuitous and unanticipated benefits.

Additional factors that could be affecting fisher conservation include:

1. Regulatory mechanisms on private lands may not adequately protect late seral forest habitat elements important to fisher, and may be limited in recruiting such elements in the future.
2. Fishers are forest habitat specialists and need late seral elements (large trees and snags with cavities, large limbs, downed logs) for denning and resting sites.
3. No large-scale combined private/public habitat conservation plan or conservation strategy exists for conservation of the fisher population in northern California.
4. No landscape-level late seral retention plan exists via the FPRs for the private ownerships in northern California in fisher range.
5. Fishers have relatively small litter sizes, and females may not breed or bear young every year, and prey populations also exhibit interannual variability.
6. No systematic or large-scale population monitoring is occurring in northern

California, and the fisher is not a monitored species under the NW Forest Plan.

7. Population monitoring at a large scale is expensive and funding is scarce.
8. Late seral forest habitat retention policies and management direction on public land has occurred relatively recently compared to the time period needed (200 yrs or more) for trees to exhibit the structural characteristics required by fisher for den and rest sites.
9. In much of northern California, public lands exist in a matrix with private lands. Fishers do not recognize these administrative boundaries, and rigorous large-scale demographic studies have not been conducted on fisher.
10. Generalist predators (e.g., coyotes and bobcats) of fishers may fare better in managed landscapes than fisher do, and predation rates may help suppress fisher population expansion.

## **Existing Management Efforts**

This section provides brief summaries of some existing management efforts regarding fishers or forest management on federal, private, and tribal lands.

### **U.S. Forest Service**

The fisher is designated as a sensitive species by the USFS, and therefore receives special management emphasis to ensure its viability and to preclude trends toward endangerment that would result in federal listing. USFS management direction is to use the best available science, and recent fisher conservation and research efforts in the southern Sierra Nevada are indicative of that.

*Management Indicator Species.*- The fisher was designated as a Management Indicator Species (MIS) on the Inyo, Lassen, Sierra, Stanislaus, and Tahoe

national forests until the December 2007 adoption of a Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) eliminating the fisher as an MIS on these national forests. The stated reason for this action was the desire to bring efficiency to the monitoring responsibilities of the USFS across all Sierra Nevada forests. The fisher was dropped from the list of MIS because of “limited distribution in the Sierra Nevada” and the unlikely ability of population trend information to “provide useful information to inform forest service management at the Sierra Nevada scale.”

The Department understands the fisher is a Forest Service sensitive species, and as such must receive special management emphasis to ensure its viability and to preclude trends toward endangerment that would result in Federal listing. While there may not be a legal requirement for conducting intensive monitoring of fishers, continued trend monitoring is needed to inform forest managers in meeting the “special management emphasis” threshold. The current candidate status of the fisher by the Service adds incentive for the USFS to continue monitoring for fisher at its current level.

*Sierra Nevada Forest Plan Amendment (SNFPA).*- The desired goal of the Old Forests and Associated Species section of SNFPA is to increase the density of large trees, increase structural diversity of vegetation, and improve the continuity and distribution of old forests across national forest landscapes. The monitoring plan for old forests was developed to address community and ecosystem management goals. The monitoring plan addresses issues of the amount and condition of old forest, and the vegetative structures characteristic of old forest function and habitat suitability for associated species. Remote sensing will be used to monitor changes in forest conditions at a broad spatial scale. Relative to fisher, the primary concern is the “area treatments” to reduce wildfire risk. The conservation strategy for fisher focuses on limited operating periods near natal dens, retention of large snags and logs, minimizing the effects of treatments on large trees, snags, and logs, and the maintenance of large oaks in conifer stands, among other things. The strategy also recognizes roadkill as a threat to fisher. A Southern Sierra Fisher Conservation Area was delineated where fisher conservation is the goal. The combination of population and habitat monitoring will help determine if the conservation strategy is effective in increasing the fisher

population and in increasing the amount, quality and distribution of fisher habitat.

The King's River management area in the southern Sierra was excluded from the SNFPA, and is an area where fisher are currently being studied as part of understanding how controlled fires and thinning may affect fisher.

On December 10, 2009, the Forest Service issued a Notice of Intent to Prepare a Supplemental Environmental Impact Statement (SEIS) to the 2004 Sierra Nevada Forest Plan Amendment (Framework) Final SEIS. The new SEIS is being prepared in response to an order issued in November 2009 by Judge Morrison C. England of the Eastern District Court regarding the two lawsuits against the 2004 Sierra Nevada Forest Plan Amendment decision. A USFS interdisciplinary team has been assembled to prepare a narrowly-focused SEIS that responds to the Judge's direction. A Draft SEIS is anticipated to be released on February 12, 2010.

*Giant Sequoia National Monument Management Plan.* - The 327,769 acre Giant Sequoia National Monument encompasses important habitat of the southern Sierra Nevada fisher population. Twenty-four percent of the positive fisher detections in Sierra-wide surveys conducted from 1989-1994, came from the Monument area (Zielinski et al. 1997). Land altering management activities and pre-monument designation timber sale contracts were initially to be allowed within the Monument under the 2004 Giant Sequoia National Monument Management Plan. The 2004 Management Plan has been invalidated, and in June 2007, USFS initiated the planning process for a new Management Plan. The new management direction that will be proposed for the Monument is unknown, but in invalidating the 2004 plan the Ninth Circuit Court of Appeals found that the USFS overemphasized timber harvest (Lockyer v. USFS et al.). Additionally, the new plan will be subject to all Sequoia National Forest planning policies (including the Sierra Nevada Forest Plan Amendment) with the addition of an overriding purpose of protecting the scientific and historical objects identified in the Monument's enacting Proclamation. President Clinton's April 15, 2000 Proclamation specifically noted the fisher as an important scientific object in the Monument. Therefore, the new Management Plan may allow for less active management of fuels and improvements than occurs on Sierran National Forests. Until the new plan is finalized, the Department cannot determine the

benefits to the fisher. Scoping for public comments is currently underway.

*Northwest Forest Plan (NWFP).*- The Department notes the fisher is not a monitored species under the NWFP, and therefore, in contrast to the southern Sierra fisher population, there is no comprehensive monitoring program in place for fisher populations in northern California. The Department understands that thinning in stands less than 80 years old in Late –Successional Reserves (LSRs) must be beneficial to the creation and maintenance of late-successional conditions, and such a prescription has the potential to provide some resting or denning habitat for fisher in the future.

Zielinski et al. (2006) used spatially-explicit, empirically derived habitat suitability models for the northern spotted owl and fisher to examine the conservation value of the LSRs set up under the NWFP. The authors found low correlation in the landscape habitat suitability values for the two species (Spearman rank correlation coefficients of 0.111 or 0.162, depending on scale). The authors found the LSR system does not appear to provide the highest conservation value on the national forests in northwestern California for spotted owls or fishers. With particular regard for the fisher, the authors state the LSRs, “with their emphasis on geographic distribution may lack the connectivity necessary” for wide-ranging and non-flying mammals like the fisher. The authors note the LSR system was developed without the benefit of habitat suitability models for either species, and with only an evaluation by species experts on the effects of the LSR proposal on species other than the spotted owl. Fishers were considered to be among the mammals with the lowest likelihood of remaining well distributed throughout the system (Zielinski et al. 2006).

## **Other Public Lands**

### **Bureau of Land Management (BLM)**

BLM lands are subject to the Northwest Forest Plan (NWFP) provisions, though consultation with the Service is not required on projects that may affect fisher habitat, though the fisher is a candidate species. However, the fisher is also classified as a species of concern under BLM management and thereby receives special attention.

BLM conducted surveys for fisher in the Lack's Creek Late Successional Reserve and in the King Range in 2008. These surveys are voluntary and not required under the NWFP. BLM conducted fisher surveys in the Headwaters Forest in 1999, but no fisher detections were made. There are no plans for additional surveys in Headwaters, at this time. BLM biologists are participants in the west coast fisher conservation assessment and strategy process being led by the USFS and the Service.

#### National Park Service - Yosemite National Park

At this time, there is not a management program specifically aimed at fishers, but there are guidelines associated with programs that affect forest habitat, such as prescribed fire, mechanical fuels reduction, and hazard tree management. There is not a strict "let it burn" policy in effect. The guidelines provide life history traits of the fisher and identify habitat components that are important and should be preserved, if possible, in vegetation management programs. Retention of snags and oaks is encouraged, and fuel treatments that result in heterogeneous forest structure are encouraged (e.g., fire may make some habitat unsuitable for fishers, but suitable habitat would remain interspersed). A snag retention protocol for the fire program exists and is currently being utilized (pers. comm., S. Thompson).

Yosemite National Park (YNP) hosted a fisher workshop in May 2009 to better understand fisher biology, hear results of ongoing studies, and to identify research and management needs, and opportunities for collaboration on fisher research. YNP staff recently received grant funding to work collaboratively with U.C. Berkeley and the Department to better understand fisher distribution in the park, and to explore factors that may be constraining fisher dispersal north of the Merced River.

#### National Park Service - Sequoia King's Canyon National Park

Like other national parks, Sequoia-King's Canyon National Park (SKCNP) manages natural ecosystems, and therefore does not have specific management documents or policy for fisher. Additionally, the NPS does not itself have a



classification of sensitive species, but they consider species so designated by other agencies, including species of special concern and listed species. Candidate species under ESA are managed closely, as though listed, and are addressed in planning documents.

Most existing park developments in SKCNP straddle the most suitable habitat for fisher. SKCNP is in the process of attempting to get funding for research that will address how fisher may be affected by park developments and park roads. They are also interested in research on the relationship between their fire management program and fisher (H. Werner, pers. comm.).

### **State Lands**

State lands compose only about 1 percent of fisher range in California. State agencies are subject to CEQA, thus, the fisher should receive special management attention as a species of special concern, and more notably as a candidate species under ESA and CESA. Recreation is one potential threat to fisher on some state park land, and timber harvest on state forest lands could contribute to decline in fisher habitat quality and quantity if not adequately mitigated.

### **Private Lands Forest Management**

The Department estimates that approximately 38 percent of current fisher range in California encompasses private or State lands regulated under the California Environmental Quality Act (CEQA), the Z'berg-Nejedly Forest Practice Act (FPA), and associated regulations. As indicated in the petition, the California Forest Practice Rules (Title 14, California Code of Regulations [14 CCR] Chapters 4, 4.5, and 10, hereafter generally referred to as the FPRs) are the primary set of regulations for timber management projects on private and State lands in California. The petition described the FPRs sections considered most relevant to fisher management and concluded the FPRs “do not regulate logging on private lands in a manner that is adequate to maintain fisher habitat or populations on private lands in California.” In particular, the petition stated the FPRs do not offer specific protections for fisher or their habitat, do not provide a mechanism for identifying significant impacts (including cumulative impacts) to fisher, and

provide for and encourage extensive and intensive harvest of forests using methods that remove or degrade fisher habitat suitability. The petition also stated protections within the FPRs for other listed species are not adequate to protect the fisher. The petition covered these general areas (and page numbers in the petition) in discussing the FPRs:

- Regulations and their protection of fisher habitat (p. 61-63)
- Exemptions to the Timber Harvest Plan (THP) process (p. 63-64)
- Mitigation and assessment of impacts to fisher habitat (p. 64-65)
- Retention of snags (p. 65)
- Protections in place for other species that would accommodate and protect fisher habitat (p. 65)
- Conservation plans (p. 66)

The Department reviewed each of these general areas for the petition evaluation and the status review:

#### Regulations and their protection of fisher habitat

The fisher is not currently designated a “sensitive species” as defined under FPR 895.1. Sensitive species can be designated by the Board of Forestry and Fire Protection (Board) under a process described in 14 CCR 919.12, 939.12, and 959.12. It is possible that, were the fisher a sensitive species, protection measures could be crafted to minimize impacts of timber harvesting to fishers and their habitat.

The petition stated the FPRs do not offer specific protection of fisher den sites, except potentially under 1038(i) relative to old and large trees. This is correct, although some aspects of the FPRs may contribute to fisher den tree retention. The petition did not consider the provision in the FPRs for Watercourse and Lake Protection Zones (WLPZ). WLPZ are zones of selection harvest along streams intended to protect instream habitat quality for fish and may encompass 50 and 150 feet on each side of a watercourse (100 to 300 feet total width). Thus, WLPZ may encompass approximately 15 percent of the landscape (Department of Fish and Game, unpubl. data). Drier regions of the state with lower stream densities would be expected to have a much lower proportion of the landscape in WLPZ. Where they occur, and where they are managed to allow large trees with

cavities and other den structures to develop, WLPZ may eventually provide fishers a network of older forest structure within the managed forest landscape. These lands are still recovering from previous practices in which no provision for streamside buffers was made. Some existing den trees may incidentally be retained in WLPZ along streams containing listed salmonids, where the 10 largest conifer trees per 330 feet of channel length must be retained. Outside of watersheds with listed salmonids, the FPRs require retention of two conifers per acre greater than 16 inch dbh and 50 feet in height in Class I and Class II WLPZs. Maintenance of FPR-specified canopy closure for WLPZ on other streams may also result in the incidental retention of some den trees. The FPRs do not require these trees to be permanently retained. Den trees may also be retained to help achieve post-harvest stocking standards after some harvests under the “decadent or deformed trees of value to wildlife” provision of FPR 912.7, 932.7, and 952.7. While some provisions of the FPRs address fisher den and cover trees and habitat elements, the effects of these laws on fisher population is unknown.

The petition stated the FPRs allow for “degradation and destruction” of critical features of fisher habitat because the focus is on logging for “maximum sustained production.” Timber management can affect fisher both directly and indirectly through habitat modification. Timber harvests can alter habitat and make it unsuitable or less suitable for fisher, either by reducing the area of dense canopy forest within a fisher home range or by removing the critical habitat elements (trees with cavities or other den sites) supporting fisher use. Timber management can also affect fisher by establishing and increasing road density (see section on roads). In general, the petition is correct to suggest the FPRs allow for the management of private and State forests in a condition of relatively young-aged stands patchily distributed and created by regeneration harvests and with low densities of trees and snags suitable for denning fisher.

The petition addressed the silvicultural methods available under the FPRs and concluded most of these methods will negatively affect fisher habitat suitability. After harvest using an even-aged regeneration method such as clearcutting, a forest stand will not develop sufficiently dense canopy cover for fishers to travel and forage in for a period of a few to several decades, depending on the forest type. Even-aged regeneration methods also can be expected to remove habitat

elements essential for denning and further reducing habitat suitability. The intermediate treatment of commercial thinning is considered a step leading toward even-aged harvest and could, over time, result in the same habitat suitability decreases.

The petition addressed the role of the FPRs (14 CCR 919.16, 939.16, and 959.16) in conserving late succession forest stands. Late succession forest stands are defined in the FPRs (14 CCR 895) as moderate to dense canopy stands with a quadratic mean diameter at breast height of 24 inches or greater, at least 20 acres in area, and with large decadent trees, snags, and large down logs. Such attributes provide for the life requisites of fishers at the stand scale. The petition considered that this rule section does not provide appreciable protection for older forest stands and the Department concludes this can be true for two reasons. First, the limitation of the rule section to late succession stands 20 acres or greater in area precludes the obligation to assess and disclose the presence of late seral stands less than 20 acres in area. These smaller stands can provide some habitat value for fishers. Second, this rule section does not require any specific mitigation be applied to late succession stands where they do encompass 20 or more acres, and thus degradation to these stands may result.

Comments received (Self et al. 2008, Carr 2008) mentioned the role of sustained yield plans and Option A plans (under 14 CCR 1091.1 et seq., 14 CCR 913.11, 933.11, 959.11) in protecting fisher habitat. These plans are required for ownerships encompassing at least 50,000 acres and are intended to demonstrate over a 100-year planning period that timber growth at least matches harvest. Consideration of other resource values, including wildlife, is also given in these plans, which are publicly reviewed and approved by CALFIRE. In the Department's opinion, these plans may not be sufficient to ensure the habitat needs of species like the fisher, which relies on the largest hardwoods and conifers not typically modeled in growth and yield projections; plans should work to model and include old forest attributes that are of importance to fisher life history. To the extent the Department believes that these plans are not sufficient to ensure habitat needs of species like fisher, the Department can identify the impacts as significant under CEQA, and recommend avoidance or other measures to mitigate significant impacts to below a level of significance. The

Department's view is that the FPRs and CEQA can provide necessary protection for fisher if applied appropriately and consistently. The Department intends to continue working with CALFIRE to ensure that existing laws are appropriately and consistently implemented for the benefit of the fisher.

In comment letters submitted by representatives of northern California industrial timberland owners and managers and on behalf of the California Forestry Association (Self et al. 2008, Ewald 2008, Carr 2008), several voluntary management policies are mentioned that may contribute to conservation of fishers and their habitat. One or more of the companies represented in these comments have policies for retention of snags, green trees (including trees with structures of value to wildlife), hardwoods, and coarse wood debris. The variety and complexity of approaches taken by the companies, and the lack of specific information provided for some of the policies, precludes an adequate analysis of their efficacy during the petition evaluation period.

Many of these voluntary policies do result in better conservation of fisher habitat elements than are specifically required by the FPRs. Because these policies are, in most cases, voluntary (even those tied to third-party forest stewardship certification), there is little tangible accounting for their implementation by agencies; nor is there assurance the policies will be implemented consistently in the future. Non-industrial landowners, who comprise a significant proportion of the fisher's geographic range in California generally do not have comprehensive policies for wildlife habitat, so the minimum protections required by the FPRs would apply to most of these timberlands. Efforts to improve the implementation and enforcement of the FPRs and CEQA would be beneficial to fisher, as would establishing a methodology to better track the voluntary efforts being implemented.

Self (2008b) discussed several of the FPR sections and their contribution to protection of fishers and fisher habitat. Self (2008b) suggested the FPRs intent language under 14 CCR 897(b)(1)(B) provides an over-arching protection mechanism for all wildlife, including fisher. This rule section states forest management shall "maintain functional wildlife habitat in sufficient condition for continued use by the existing wildlife community within the planning watershed." Meeting this intent would provide for the viability of fishers although the FPRs do

not provide specific direction on how to manage timberlands for fishers.

#### Exemptions to the Timber Harvest Plan (THP) process

CALFIRE advised the Department that large acreage ownerships may want to take out trees damaged and are not exempt from the FPRs, but may be exempt from a THP. Hence large acreage would mean they could take out damaged trees on their overall property. The limit on removal under exemption is 10 percent per acre of volume. CALFIRE indicated large landowners typically get an exemption for their entire property annually for convenience, and it does not mean they will be harvesting all the dead wood out of that acreage. CALFIRE recommended that the volume harvested, rather than acres under exemption, was a more appropriate figure to assess exemption harvest. Trees typically harvested under an exemption are dead, dying or diseased trees or hardwoods used for fuelwood. Additionally, extensive areas of wildfire burned area may be harvested under exemption and can be misleading in evaluating the effects upon wildlife such as the fisher. An example suggested by CALFIRE was the 64,000 acre Fountain Fire in northern California in 1992. It is difficult to suggest that such large burned landscapes are, or would be, fisher habitat for many decades.

Sanitation-salvage harvests target dead, diseased, and dying trees that are often the trees most likely to have suitable fisher den structures. As discussed in the petition, this could result in the removal of key habitat elements for the fisher. Sanitation-salvage as used in some exemption harvests under FPR 1038 is exempted from review by the interagency review team. As described in the petition, these harvests may be extensive and naturally target diseased/dead trees, some with a likelihood of providing suitable den sites for fishers. Harvest operations must still comply with all aspects of the FPRs and with CEQA. There are restrictions as to the circumstances and volume of trees that can be harvested under an exemption.

#### Mitigation and assessment of Impacts to fisher habitat

The petition discussed the role of the FPRs (14 CCR 919.4, 939.4, and 959.4) in the development of mitigation measures for significant impacts to non-listed species. It also discussed the cumulative impacts assessment process in the

FPRs. The Department believes the petition's discussion of mitigation measures for non-listed species to be correct. However, in the Department's experience, neither of these processes has resulted in the development and consistent application of specific mitigation measures for significant impacts to fisher, including impacts to the species' habitat. Technical Rule Addendum No. 2 is relevant to cumulative impacts. In the biological resources section, harvest plans must address factors such as snags, den trees, rest trees, downed large woody debris, multi-story canopy, road density, hardwood cover, late seral forest characteristics, late seral habitat continuity, and any other special habitat elements. Although this list is comprehensive and would result in disclosure of potential cumulative impacts to the fisher, the Department believes that most harvesting plans conclude that no significant cumulative impacts will occur because of mitigation and recommendation measures to reduce the impacts to less than significant. The Department believes that without additional regulations, policy, or guidance, Technical Rule Addendum No. 2 does not currently provide adequate protection for fisher habitat.

#### Retention of snags

Snags (standing dead trees) are commonly used by fisher for denning and resting (for example, see Zielinski et al. 2004 and Reno et al. 2008). Although the FPRs requires "all snags shall be retained to provide wildlife habitat" within harvest areas, the FPRs also require any snag posing a safety, fire, insect, or disease outbreak hazard be felled, and also allow the felling of merchantable snags. Because certain tree species (such as coast redwood or western red cedar) with the longest period of merchantability after death also provide the longest-lasting habitat value, this provision effectively limits the number of snags that may be available for use by fisher. Regardless of the merchantability standard, the FPRs only require retention of existing snags when present – the recruitment of future snags to replace existing snags as they deteriorate and are lost is not a process for which THPs plan. Appropriate and consistent implementation of CEQA in conjunction with the FPRs and review of THPs, should avoid significant impacts to fisher, or result in them being mitigated to a level of less than significant. This would help ensure the retention of adequate snags for fisher.

### Protections in place for other species that would accommodate late successional habitat

The petition discussed the protections in place for the northern spotted owl and marbled murrelet and that there is no guarantee that protecting late successional owl habitat will result in substantial protection for the fisher. Although marbled murrelet nest stands are not available for harvest and should function as suitable fisher habitat, the total area of such stands on private lands is only a few thousand acres statewide. Protections in the FPRs for the northern spotted owl only apply to lands within the range of that subspecies, which includes the north coast, and the Klamath and southern Cascade mountains. If, northern spotted owls move their nest site or center of activity, the previously-occupied stand may become available for harvest. In such cases, the indirect protection of fisher habitat derived from that owl stand could be diminished or eliminated, and may be moved to a different area of protection.

The California spotted owl (*Strix occidentalis occidentalis*) in the Sierra Nevada is not listed as threatened or endangered and the Department is unaware of a habitat retention requirement for this species in the FPRs. Within the range of the northern spotted owl, the habitat retention requirements of the FPRs alone, as summarized by the petition, may not be sufficient to meet fisher life history requirements because fisher have a much larger home range, although the general practice of retaining a core patch of nesting and roosting habitat around northern spotted owl nest sites would contribute to the amount of habitat available to fishers in the area. Overall, the Department believes the FPRs provisions for marbled murrelet and spotted owl can provide specific areas of protection, but alone, may not provide significant acreage protection specifically for fisher throughout its geographic range in the state although this is largely unevaluated.

### Conservation plans

The petition discussed habitat conservation plans (HCP) developed by industrial timberland owners on the north coast: Pacific Lumber Company (PL, note PL is now Humboldt Redwood Co.), which has a multi-species HCP and Green Diamond Resource Company (GD), which, as Simpson Timber Company,



developed a northern spotted owl (NSO) HCP. GD also recently completed an Aquatic HCP for anadromous salmonids and amphibians. The petition stated that neither of these plans have specific protections for the fisher.

The PL HCP was designed to provide adequate habitat to ensure the fisher will inhabit PL lands. The HCP covers about 200,000 acres of mostly second-growth forest in Humboldt County, defines management of timber harvesting activities on a landscape scale, and provides protection for the northern spotted owl, marbled murrelet, listed salmonids, and a variety of non-listed species, including fisher. The HCP includes either or both habitat-based standards and performance-based standards for each of the covered species. For the fisher, the HCP points to the requirement to maintain at least 10 percent of several planning compartments on PL lands in a late seral condition and other HCP measures as sufficient to meet the landscape canopy cover needs of the fisher. HCP measures, including habitat standards for the northern spotted owl and marbled murrelet, and especially requirements to retain snags and trees of value to wildlife, are intended to contribute to fisher habitat quality. In addition to snags, snag replacement trees, and large hardwoods, the HCP specified the retention of up to four “live cull” trees per acre where they exist in timber harvesting plans. Issues regarding interpretation of the of the live cull tree retention requirement has affected implementation of this measure. However, efforts are underway to address the concern.

The Department does not know whether the GD NSO HCP and Aquatic HCP alone are sufficient to ensure that fisher will continue to inhabit GD lands in the future. The GD HCPs cover mostly second and third-growth forest on about 440,000 acres in Humboldt and Del Norte counties. The GD NSO HCP includes provisions for about 13,000 acres of NSO set-aside areas intended to protect existing NSO sites and to promote the development of NSO habitat. The recently-approved Aquatic HCP provides for increased streamside buffer areas on GD lands, along with provisions for retention of some hardwood trees along intermittent streams. These HCP measures contribute to fisher conservation, although long-term stability in the future is unknown and will be dependent on both GD lands and lands owned and administered by others where the fisher range. GD has also developed a policy (the Terrestrial Dead Wood Management Plan) to retain many of the trees of highest wildlife habitat value, which, though

not an enforceable requirement during timber harvest planning, will contribute to fisher conservation. Comment letters (Ewald 2008, Self 2008b, Carr 2008) were received that briefly describe the Green Diamond HCPs and Terrestrial Dead Wood Management Plan. The Department agrees the HCPs and the voluntary policies of Green Diamond contribute to habitat retention for the fisher.

Although not mentioned in the petition, Mendocino Redwood Company is developing an HCP/NCCP for its approximately 230,000 acres in Mendocino and Sonoma counties. Because this is a plan in development, its performance relative to fisher is unknown. Fisher have not been detected during recent mesocarnivore survey efforts in the coastal redwood/Douglas-fir forests in proximity to the proposed plan area. In drafting the plan, MRC has chosen not to seek coverage for the fisher. Rather, the intent is to develop a plan that includes conservation measures devised for other purposes that should enable plan amendment to provide fisher coverage with minimal alteration. In addition to moving towards primarily uneven-aged silviculture across the plan area, the plan includes conservation measures that should benefit fishers such as substantial aquatic management zones (i.e., enhanced WLPZ buffers) inclusive of high degrees of canopy closure and largest tree retention, retention of un-entered old growth stands and minimal harvest in lightly-entered old-growth stands, minimum standards for downed logs, maintenance and recruitment of wildlife trees (including all old-growth trees) and snags across the managed landscape, minimum standards for hardwoods, retention of productive spotted owl activity centers and increasing the area of nest-roost habitat over the plan period, and highly restricted silviculture in lower Alder Creek (an area occupied by marbled murrelets).

The FPRs lack of specific protections for the fisher could reduce fisher habitat suitability. However, information submitted during our reviews of the petition, and of the fisher status, indicated fisher do use and inhabit industrial timber lands to meet all or some of their life requisites. The degree to which current FPRs and timber management of the landscape affects fisher habitat suitability and the fisher population remains unknown in the absence of both fisher population monitoring and sufficient compliance monitoring of the FPRs. Lack of retention of late successional stands could reduce local habitat suitability and the cumulative effect could reduce suitability over large areas, however, lacking sufficient

monitoring, there is no evidence assessed during this review that current practices have reduced, or will imminently reduce, long-term population viability.

Lastly, as it relates to management of private timberlands, implementation of the regulations does not mean *per se* that private timberlands will be managed such that they chronically reduce habitat suitability for fishers. Harvest history, market conditions, site productivity, voluntary measures, company philosophy as well as other factors, including appropriate and consistent application of CEQA, also influence how private timberlands are managed and their suitability for fishers. Additionally, protections for old forest components and potential fisher habitat on private lands are in a better state than in decades past as a result of environmental regulation.

#### Sierra Pacific Industry Candidate Conservation Agreement with Assurances

The USFWS “Candidate Conservation Agreement with Assurances for Fisher” (CCAA) with Sierra Pacific Industries regarding translocation of fisher from the existing northern California population to the northern Sierra Nevada is in effect. This agreement is between SPI and the USFWS and was approved on May 15, 2008. CCAAs are intended to enhance the survival of a covered species into the future and would provide incidental take authorization from the USFWS if the fisher is listed under the federal Endangered Species Act during the 20-year permit period. The CCAA covers timber management activities on SPI’s Stirling Management Area, an approximately 160,000-acre tract of second-growth forest in the Sierra Nevada foothills of Butte, Tehama, and Plumas counties. This tract is in the northern portion of the gap in the fisher distribution, and it is apparently not currently occupied by fisher.

The CCAA identifies the Stirling Management Area as the location for receiving translocated fisher in the effort to study the translocation effort and ultimately, possibly re-establish fisher in the northern Sierra Nevada. The Department completed a CEQA document and translocation plan prior to the initiating the effort in late 2009.

Concern was expressed that the CCAA would involve translocation to less than optimal habitat was countered by the recent information demonstrating fisher use

of habitat that is not late seral, and the fact that many wildlife occur in suboptimal habitat as long as required habitat elements are available and the habitat is suitable. The information received from several private timber companies indicated substantial fisher use of intensively managed forests. Stand characteristics in terms of tree age and canopy closure being inhabited were typically lower than those reported in the literature from researchers working largely on public lands and lower than that reported in the petition. The U.S. Forest Service in its Conservation Assessment has similarly indicated that contrary to the long-held perception that fisher specifically inhabit late successional forest, fisher are using forest systems that are not considered old growth. Still, these studies on private timberlands do indicate that old elements that were retained in these stands, such as large, old oak trees, are important attributes of the habitat for the fisher whether for resting or denning.

The CCAA obligates SPI to maintain a minimum of 20 percent of the tract in a condition known as “Lifeform 4” and to increase the amount of Lifeform 4 to 33 percent of the tract over the permit period. Lifeform 4 stands have trees with a quadratic mean diameter of at least 13 inches, at least 60 percent canopy closure, and at least 9 trees per acre (on average) at least 22 inches diameter at breast height (dbh). Where even-aged management is practiced, the retention standard is at least 20 trees 22 inches dbh or greater per acre (on average). Lifeform 4 stands must also have at least one potential fisher den tree (conifer at least 30 inches dbh or hardwood at least 22 inches dbh).

The Department believes stands meeting the Lifeform 4 criteria could be suitable fisher habitat, although whether a landscape containing 20- 33 percent of such habitat will sustain reintroduced fisher will be part of the translocation experiment and will depend on the spatial arrangement of the retained trees and the Lifeform 4 stands, as well as whether the retained trees are mostly hardwoods. Although modeled by Davis et al. (2007) as an area of apparent low habitat suitability for fisher based on their input variables, some of the recent information on fisher inhabiting industrial timberlands indicated that less than optimally-predicted habitats are inhabited by fisher—indicating the models do not represent the entire breadth of suitable habitat characteristics.

The SPI CCAA was mentioned in comment letters regarding the petitioned action

(Self 2008a, Tomascheski 2008, Carr 2008). Self (2008a) summarized the CCAA from SPI's perspective including identification of what they considered inaccuracies in the petition regarding the CCAA development process and intent. Carr (2008) mentioned the CCAA and its provision to increase denning habitat from 22-33 percent of the Stirling Management Area.

The Department is supportive of the CCAA and considers the translocation project a highly desirable project for the species. Fisher have been among the most frequently translocated animals in North America (Drew et al. 2003). The Department's wildlife program and Wildlife Investigations Laboratory (WIL) have over the decades led many successes at translocating species that were less numerous than the fisher (Sierra Nevada bighorn sheep, desert sheep, tule elk) to re-establish populations in former range; recent efforts with the gray wolf in the Yellowstone ecosystem indicate how successful such efforts can be with carnivores. The WIL is comprised of wildlife capture techniques specialists, wildlife veterinarians, and biostatisticians trained in animal capture, handling, disease investigation, translocation, and study design. Rather than waiting for the fisher, which isn't known to be a very good disperser, management agencies should facilitate recolonization to their former range. Zielinski et al. (1995), Jordan (2007), and Drew et al. (2003) among others, advocated that translocation of fisher may be one of the most effective management tools at our disposal in California.

### **Translocation Update**

Translocation is a management technique that has been successfully used to reestablish fisher in North America and is being used by the Department to reestablish fisher to its historical range in California. This effort is being done in cooperation with SPI and the U.S. Fish and Wildlife Service. A primary conservation concern for fisher has been the apparent reduction in overall distribution in the state. Establishing another population in formerly occupied range is believed an important step towards strengthening the statewide population in California.

The Department assessed the feasibility of translocating fishers to properties owned by SPI within the unoccupied portion of the fisher's historical range in the

northern Sierra Nevada (Callas and Figura 2008). Five areas were offered for consideration by SPI. They represent most of the large, relatively contiguous tracts of its land within the southern Cascades and northern Sierra Nevada.

A variety of factors were used to assess the feasibility of reintroducing fishers to these areas including habitat suitability within candidate release sites, prey availability, genetics, effects on other species with special status, disease, predation, and effects of removing animals on donor populations. Three GIS models were used to evaluate potential fisher habitat at candidate release sites and elsewhere within the fisher's unoccupied range in the southern Cascades and northern Sierra Nevada. The model, based on the California Wildlife Habitat Relationships System, predicted substantial habitat to be present within these areas. However, other models based on the characteristics of locations of fishers in currently occupied areas predicted comparatively little habitat of moderate or high suitability within the unoccupied areas assessed. Field visits with those model interpretations were made by Department, SPI, and USFWS personnel during 2009 and the consensus was that the model predictions at numerous sites were incorrect in their assessment of the habitats.

Data collected by SPI at thousands of inventory plots within each of the candidate release sites provided a detailed picture of the density of habitat elements such as large hardwoods, snags, and large trees considered important to fishers. The density of many of these elements within some candidate release sites was similar to, and in some cases exceeded, the density of those elements on other portions of its property currently occupied by fishers. Of the candidate release sites evaluated, all three GIS-based models indicate that SPI's Stirling Management Area contained the most suitable habitat.

Between November 24, 2009 and January 31, 2010, 19 fishers were captured using live traps in Siskiyou, Shasta, and Trinity counties (Figure 14). Most fishers (11) were trapped on commercial timberlands owned by SPI or Timber Products Company. Eight fishers were captured on land administered by the Bureau of Land Management or the USDA Forest Service.

All fishers captured that met initial target criteria (age and sex) upon examination while in the trap were transported to a captive holding facility. Potential

candidates for translocation were chemically immobilized, given a physical examination, vaccinated for distemper and rabies, treated for parasites, and blood/fecal/nasal samples were collected for disease testing.

Female fisher meeting health and body weight criteria were surgically implanted by a Department wildlife veterinarian with a VHF radio transmitter. Male fisher meeting initial health and weight criteria were fitted with a GPS collar. Biological samples collected while fishers were immobilized were shipped to U.C. Davis for canine distemper and canine parvovirus testing. No animals with evidence of previous exposure to canine distemper or that were actively shedding parvovirus were translocated.

Of the fishers captured for translocation, 15 (9 female and 6 male) met health and other screening criteria and were released within SPI's Stirling Management Area (Figure 14) during December 2009 to early February 2010. These animals are being intensively monitored as part of a research project under the direction of Dr. Roger Powell in collaboration with the Department, the Fish and Wildlife Service, and SPI. A graduate student and field technicians are working on the project under Dr. Powell's direction.

These recently translocated fisher are not considered in this status review relative to range and distribution.

### **California Environmental Quality Act (CEQA)**

Most commercial timber harvesting on State and private lands with fisher habitat is subject to environmental review equivalent to CEQA under CALFIRE's certified regulatory program, which involves environmental review through CALFIRE's functional-equivalent timber harvest review process. In addition, some projects not involving the commercial harvest of timber, such as highway projects, housing developments, and recreational developments could impact fisher habitat and would be assessed under CEQA. The petition's statements regarding the overall conclusion that impacts to fisher have been allowed under CEQA is true. However, CEQA can be implemented appropriately and consistently to avoid and/or mitigate significant impacts to fisher before such species reach the "brink of extinction" as stated in the petition. As such, contrary

to the petition's statement, lead agencies under CEQA, including CalFire, could require avoidance, compensatory or other mitigation under CEQA for significant project-related impacts on fisher, including but not limited to measures imposed based on findings related to CEQA Guidelines sections 15380 and 15065.

Treatment of cumulative impacts and alternative analysis are two areas that could be improved on in the implementation and enforcement of the FPRs and CEQA, including the preparation of Timber Harvest Plans (THPs). Cumulative impacts are impacts that when considered individually may not be significant but when considered with many other similar projects with similar impacts, the resulting incremental or cumulative impact may be, or may become, significant. The Department has requested that CALFIRE consider the potential for significant impacts associated with the incremental loss of late-seral forest habitat, snags, logs, and canopy during its review of individual THPs. Alternative analysis requires a description of a range of reasonable alternatives to the project, or to the location of the project that could feasibly attain most of the basic objectives of the project but would avoid or substantially lessen any of the significant effects of the project. The Department's experience has been that alternatives analyses in THPs does not meet this guideline on a regular basis. Feasible alternatives in an area with fisher or fisher habitat could include retaining more hardwoods, snags, large trees and downed logs, or modifying the time of entry to avoid denning season. These alternatives would benefit fisher and are supported by the Department.

### **Hoopla Tribal Forestry**

Hoopla Tribal Forestry has been active in fisher research for almost 2 decades. The tribal lands are in a unique location near the northwestern edge of the Klamath Province, with the coast redwood ecosystem edge approximately 5-10 miles to the west. The fisher is culturally significant to the Hoopa (Hupa) people, and forest management activities are conducted with sensitivity to potential impacts to fisher. A new management plan is under development, and the Department cannot comment on its conservation value to fisher until we have reviewed it. We are currently providing some funding for ongoing work on fishers to better understand den site characteristics, juvenile dispersal, and fisher demography.



## **Tule River Tribe**

The Tule River Tribe is located in southeastern Tulare county in the southern Sierra. The tribe manages approximately 54,000 acres, of which 15,000 acres are conifer forest , and an additional 20,000 acres are potential lower elevation fisher habitat - blue oak woodland, black oak woodland, oak-chaparral mix. The tribe cooperated with USFS fisher studies in the 1990s and has documented fisher presence on tribal lands, including a sighting of a pair of fisher in blue oak woodland. The conifer zone is managed for timber production using nearly exclusively single tree selection harvest although 25-30 percent of the conifer zone is unmanaged because it is too steep or otherwise inaccessible. Timber harvest is regulated by the U.S. Bureau of Indian Affairs and is very similar to timber harvest on private lands regulated by the California Forest Practice Rules (B. Rueger, pers. comm.).

## **Recommendations for Future Management and Recovery**

The petition provided recommendations for future management of fisher. Several of the recommendations would require collaborative action on the part of various governmental agencies and other entities such as the Board of Forestry, CALFIRE, U.S. Forest Service, USFWS, private timberland owners/companies, and/or university researchers. The Department believes that collaboration in conserving, protecting, restoring, and enhancing wildlife species and their habitats is desirable. The Department is implementing some actions now, and will be developing and proposing and/or implementing actions in the near future in the effort to continue conservation and management of the fisher in California.

The Department recommends the following:

1. Obtain the scientific information necessary to define the long-term, desired condition or landscape formula for timber harvest plans, that would allow for desirable fisher habitat over a broad planning area, while allowing for commercial use and rotation plans needed by the landowner.
2. Engage all land owners/managers in fisher conservation. Initial efforts

should be directed at peer-evaluation of unpublished and recently published fisher studies to develop a better understanding of the current status of fisher in California.

3. Continue involvement with *Martes* working groups in California.
4. Continue involvement with the Interagency West Coast Fisher Conservation Assessment and Strategy Team, and prioritize management recommendations in the Interagency Strategy with others noted here to help direct available funding and staff.
5. Continue involvement with the USFS SNAMP program and southern Sierra Fisher Working Group, and work towards implementing management suggestions contained in Spencer et al. (2007:41-43); e.g., the Kings River Administrative Project Area should be a focal area for increasing habitat value and contiguity.
6. Collaboratively conduct large-scale, long-term survey and monitoring of fisher distribution and abundance across forest ownerships. Give particular attention within Yosemite and Sequoia-Kings Canyon national parks.
7. Collaboratively conduct large-scale, long-term monitoring of California fisher populations across forest ownerships.
8. Investigate fisher population demographics in managed forests to generate adequate data for population viability analyses (PVA) and assess the implications of small population size, isolation, and population genetic structure on the viability of both California fisher populations.
9. Engage in a broad efforts (e.g., Natural Community Conservation Plan) to maintain late-seral habitat elements within the managed forest landscape (both public and private lands).
10. Revise the Forest Practice Rules to require protection of late-seral habitat elements important to fisher.

11. Establish minimum thresholds in the Forest Practice Rules to retain or recruit late-seral stands within the landscape important to fisher.
12. Require timber harvest plan exemptions to proceed through usual CEQA review processes.
13. Continue research on disease relationships to better understand mortality rates and effects on fitness from the diseases known to have infected fisher populations in California.
14. Establish “fisher friendly” areas of suitable habitat in relatively narrow bottlenecks in fisher habitat to facilitate fisher dispersal and movement.
15. Plan for, establish, and maintain suitable habitat corridors between watersheds.
16. Establish corridors or large areas of suitable habitat to facilitate fisher dispersal and movement, especially near major roads/highways, and where rivers and existing land uses may act as secondary filters to fisher movements, e.g., from North to South across the Pit River and Highway 299; and in the Merced River and Highway 41 area in and adjacent to Yosemite National Park.
17. Establish multiple fisher-friendly underpasses (culverts/bridges) or overpasses along Interstates, Highways, and major roads to decrease fisher mortality from vehicles.
18. Conduct studies in cooperation with Caltrans and others to quantify fisher mortality on roads and to determine if fisher are using culverts or other devices and drainage configurations to access habitat on each side of roads.
19. Explore alternative designs to median barriers on roads with the goal of reducing fisher mortality; factor in research and monitoring to test effectiveness.

20. Reintroduce fishers into portions of their historical range and monitor the fate of such animals for several years.
21. Initiate applied research efforts and manipulative studies to better understand the fishers population response to timber harvest and other land management practices.
22. Initiate applied research efforts to assess habitat attributes as possible limiting factors for fisher including study of the availability of denning, resting, and foraging habitats.
23. Initiate working group of affected agencies (policy and science) and landowners to investigate the feasibility for fisher translocation from the southern Sierra Nevada to the central Sierra Nevada.

## **Conclusions**

The fisher in California occurs as two populations, one in northwestern California forests where its range is estimated at 8-12 million acres; and the other population in the southern Sierra Nevada where its range is estimated at 2-3 million acres. These values represent approximate total acres of range and do not reflect the actual acreage of suitable and optimal habitat that fisher inhabit.

In 2009, the Department in collaboration with US Fish and Wildlife Service, and SPI initiated a multi-year translocation project to move fisher to historical range in the northern Sierra Nevada. Fifteen fisher were released on SPI lands between December 2009 and February 2010. These animals are not considered as part of the fisher population in this status review. The intent is to release 40 animals in three consecutive years and intensively track and monitor their movements, habitat use, and survival. While it is hoped they will establish as a self-sustaining and ultimately expanding population, it will be several years before success/failure will be determined.

The fisher is considered absent or extremely rare from up to 43 percent of historical range encompassing the coast redwood area of California from Marin

County to southern Humboldt County, and in the southern Cascades and the northern and central Sierra Nevada, generally from the Pit River in the north to the Merced River in the south (essentially the northern and central Sierra Nevada). However, preliminary genetic analyses indicates that the two populations have been separated for "...thousands of years..." suggesting there would have been a gap in occurrence of fisher in the Sierra Nevada. It is doubtful the location or scale of such a discontinuous distribution can be determined if it did, in fact, exist. If such a gap occurred, then the percentage of historical range no longer inhabited would be less than the 43 percent estimate. Finally, the genetic differences recently detected do have possible implications for future conservation/management activities such as translocation.

The historical record of the fishers distribution and abundance in California is based on limited information, primarily from trapping related records. That information indicated the fisher inhabited areas of the central and northern Sierra Nevada and that they were noticeably rare in the 1910s-1920s due to trapping. It is unknown what its abundance was before that time, such as during the gold rush era and settlement period in the state. Additionally, there is very little information collected on the fisher population or distribution between the 1920s and 1980s.

Since the 1980s, many investigations/studies into fisher habitat use, selection, home range size, and preferences have been conducted; as have surveys and monitoring to assess distribution. There have been some limited study of food and foraging habits, but far more work on denning and resting habitat characteristics. More recently, investigation of genetic variability and disease have been occurring, as have modeling efforts to predict fisher viability into the future as it relates to factors such as climate change and wildfire risk. The science on fisher is increasingly broadening to large-scale, longer-term investigations rather than localized (site specific study) short-term study. From this, more population level inferences should be possible in the future.

In general, the studies indicate fisher prefer late seral forest habitat and require some of the habitat attributes or elements of late seral forests such as high canopy cover, large diameter trees, large snags, and large down logs for denning and resting habitat. Individual fisher may occupy and use multiple of these

elements within their large home ranges.

Studies also indicate that fisher inhabit managed forest on industrial timberlands wherein late seral habitat attributes exist or are left intact post-harvest, even though the stand may not be classified as late seral. While these stands may/may not be optimal habitat for fisher, it is evident in many of the reported cases that they are at a minimum, suitable habitat for fisher. It is hypothesized that fisher population densities will be lower in intensively managed forests than in late seral forests, however conclusive evidence of this is lacking.

The Department does not believe that conclusions can be drawn regarding what would be limiting the fisher populations from increasing and expanding at a detectable rate in California. It is not known whether they are increasing or decreasing in population numbers at the present time, although preliminary information in the Hoopa area and in the southern Sierra Nevada indicate they are stable to slightly increasing. The conclusion that intensive timber harvesting has eliminated habitat, and therefore the fisher population is limited or is in decline, is a relationship that has not been clearly established. Reduction in late seral forest and fisher-preferred habitat elements has occurred in California, however, for that to be limiting fisher must assume the population was at carrying capacity such that they would be limited by harvest of such habitat features. That specificity of population level information does not exist.

With recent preliminary genetic analyses, it is possible that the fisher did not continuously inhabit the Sierra Nevada from north to south. The Department is doubtful that the location/area or extent of such a potential natural gap can be determined; although there are several anecdotal observations and trapping records that indicate fisher did inhabit the central and northern Sierra Nevada in decades past. Even among fisher experts, use of these observations to infer historical distribution is not universally accepted.

The two fisher populations have not been studied for a long enough period of time or comprehensively enough to determine whether they are declining or increasing, or expanding naturally back into the Sierra Nevada or central coast redwood ecosystems, or contracting in their range. Study of the population trend is underway however, in the southern Sierra Nevada and preliminarily, it appears

they are stable in number over the past few years. It does not appear they are expanding their range, at least not in the approximate twenty year time frame in which they have become a more frequently studied species; and there is no evidence they are expanding north of the Merced River in the Sierra Nevada as detections have been rare.

The southern Sierra Nevada population is considered low, with model estimates predicting fewer than 500 individuals, although it is unknown what the capacity for increase in fisher numbers is in the area; or what the population level should be to be considered “high”. What seems more relevant is that the population may be limited by space as its only route/link for expansion is north up along the central Sierra Nevada. Predictive models of extinction risk suggest the population is at risk, yet it has been a sustaining population compared to elsewhere in the Sierra Nevada since the intensive trapping era of the past. The fisher has likely benefited from the presence of the two national parks historically, although the huge number of travelers visiting Yosemite annually now, may be a factor leading to road kill and dispersal concern.

Natural recolonization of historical range could be influenced by the low reproductive potential of the species and by land use changes that have occurred since the populations were apparently reduced in the early 1900s. There is some evidence that rivers alone should not impede natural recolonization because fishers have been documented crossing rivers in various parts of California (Appendix C, Letter from S. Farber 2009; pers. comm. M. Higley) and are able to swim (Douglas and Strickland 1999:520).

The interaction of these factors, and their combined effects result in cumulative impacts that could affect natural recolonization of former range by fisher. Additionally, long-term conservation and range expansion of the southern Sierra Nevada fisher population may be dependent on the larger northern California population if there are not adequate numbers of Sierra Nevada animals to accomplish expansion on their own or through translocation. In the event of substantial and sustained population decline in the southern Sierra Nevada from any cause, the northern population of fisher, as its closest relative, would be essential for recovery of the population. The two populations must be considered connected in terms of population rescue, though they exist hundreds of

kilometers apart at the present time. Fisher populations in Oregon and Washington cannot be relied upon at this time to rescue fisher in California, given their small population sizes in those states.

### **RECOMMENDATION**

“Endangered species” means a native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease (FGC §2062). “Threatened species” means a native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant 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 required by this chapter” (FGC §2067).

The Department recommends that designation of the fisher in California as threatened/endangered is not warranted.

### **PROTECTION AFFORDED BY LISTING**

CESA defines “take” to mean “hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.” (FGC § 86.). If the fisher is listed as threatened or endangered under CESA, take would be unlawful absent take authorization from the Department (FGC §§ 2080 et seq. and 2835). Take can be authorized by the Department pursuant to FGC §§ 2081.1, 2081, 2086, 2087 and 2835 (NCCP).

Take under FGC § 2081(a) is authorized by the Department via permits or memoranda of understanding for individuals, public agencies, universities, zoological gardens, and scientific or educational institutions, to import, export, take, or possess any endangered species, threatened species, or candidate species for scientific, educational, or management purposes.

FGC § 2086 authorizes locally designed voluntary programs for routine and ongoing agricultural activities on farms or ranches that encourage habitat for



candidate, threatened, and endangered species, and wildlife generally. Agricultural commissioners, extension agents, farmers, ranchers, or other agricultural experts, in cooperation with conservation groups, may propose such programs to the Department. Take of candidate, threatened, or endangered species, incidental to routine and ongoing agricultural activities that occurs consistent with the management practices identified in the code section, is authorized.

FGC § 2087 authorizes accidental take of candidate, threatened, or endangered species resulting from acts that occur on a farm or a ranch in the course of otherwise lawful routine and ongoing agricultural activities.

As a CESA-listed species, fisher would be more likely to be included in Natural Community Conservation Plans (FGC § 2800 *et seq.*) and benefit from large-scale planning. Further, the full mitigation standard and funding assurances required by CESA would result in mitigation for the species. Actions subject to CESA may result in an improvement of available information about fisher because information on fisher occurrence and habitat characteristics must be provided to the Department in order to analyze potential impacts from projects.

### **Economic Considerations**

The Department is not required to prepare an analysis of economic impacts (FGC § 2074.6).

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## **Personal Communications**

Dr. Carlos Carroll, Klamath Center for Conservation Research. Email to Pete Figura, California Department of Fish and Game. April 14, 2008.

Dr. Lowell Diller, Green Diamond Resource Company. Email to Eric Loft and others, California Department of Fish and Game. May 16, 2008; and presentation at Forest Carnivore Working Group, annual meeting of the Western Section of The Wildlife Society, Visalia , CA., January 29, 2010.

Jesse Garcia, Wildlife Biologist, California Department of Fish and Game, Sacramento, CA. January 20, 2010.

Mourad Gabriel, M.S., PhD candidate. Mesocarnivore Disease Ecology Project. Univ. of CA., Davis, CA. Email correspondence to Esther Burkett, California Department of Fish and Game. February 5, 2010.

Dr. Richard T. Golightly, Humboldt State University. Phone conversation with Esther Burkett, California Department of Fish and Game. May 28, 2008.

Mark Higley, Wildlife Biologist, Hoopa Tribal Forestry. Conversation with Esther Burkett, California Department of Fish and Game, January 29, 2010.

Brian Rueger, Forester, Tule River Tribe. Phone conversation with Dan Applebee, California Department of Fish and Game. April 22, 2008.

Richard L. Truex, Wildlife Biologist, USFS, Sequoia National Forest. Email to Esther Burkett, California Department of Fish and Game, January 8, 2010; and presentation at Forest Carnivore Working Group, annual meeting of the Western Section of The Wildlife Society, Visalia, CA., January 29, 2010.

Dr. Samantha Wisely, University of Kansas. Email to Richard Callas, California Department of Fish and Game . May 9, 2008.

Dr. William Zielinski, U.S. Forest Service, Pacific Southwest Research Station, Redwood Sciences Lab. Email to Pete Figura, California Department of Fish and Game. May 13, 2008; and conversation with Esther Burkett on January 29, 2010.





Figure 1. HISTORIC RANGE OF FISHER (MARTES PENNANTI) IN CALIFORNIA FROM 1862 - 1937, BASED ON GRINNELL ET AL. 1937





Figure 2. COMPARISON OF GRINNELL ET AL. 1937 FISHER RANGE MAP WITH CALIFORNIA WILDLIFE HABITAT RELATIONSHIPS RANGE



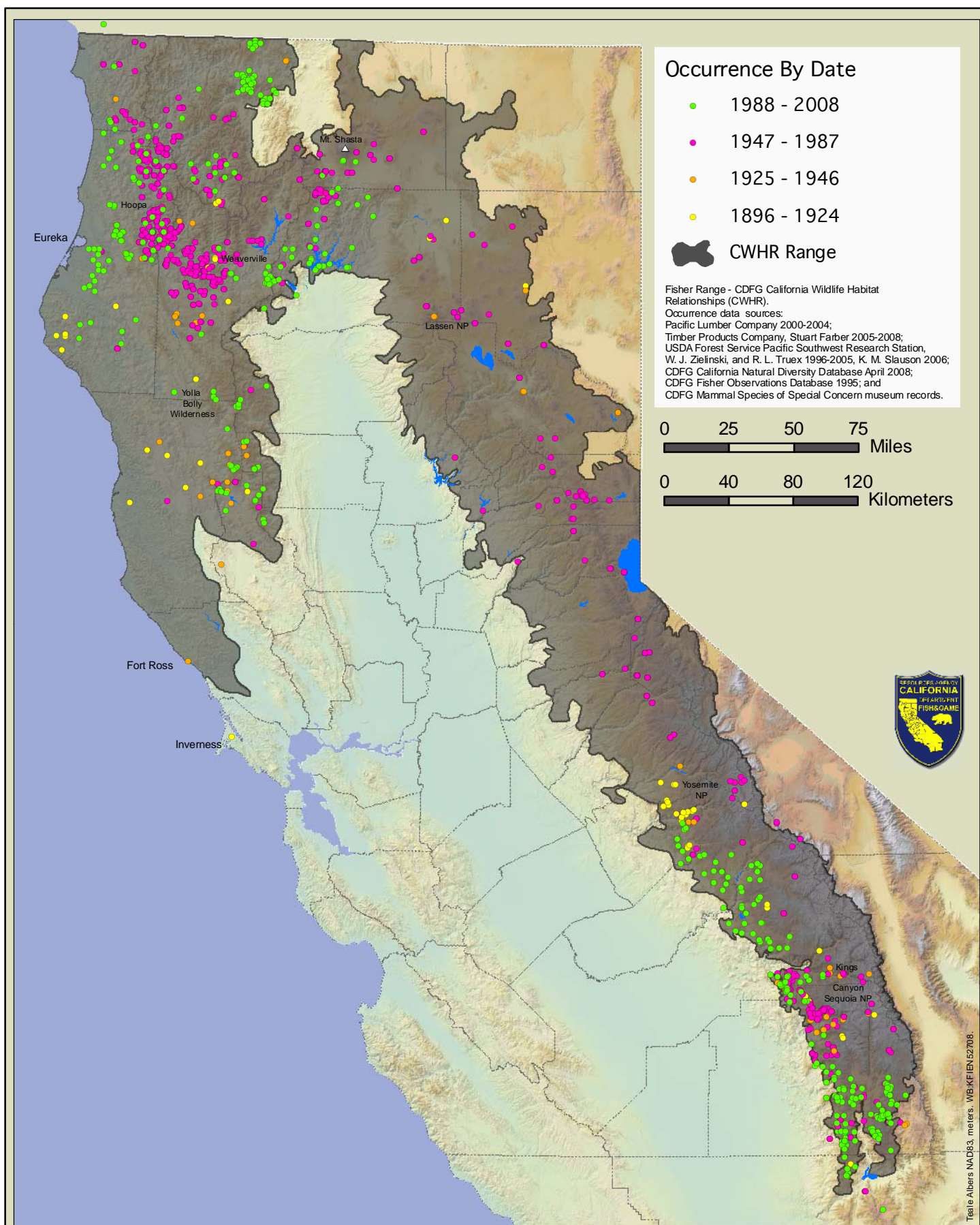


Figure 3. FISHER OCCURRENCES GROUPED BY DATE PERIODS



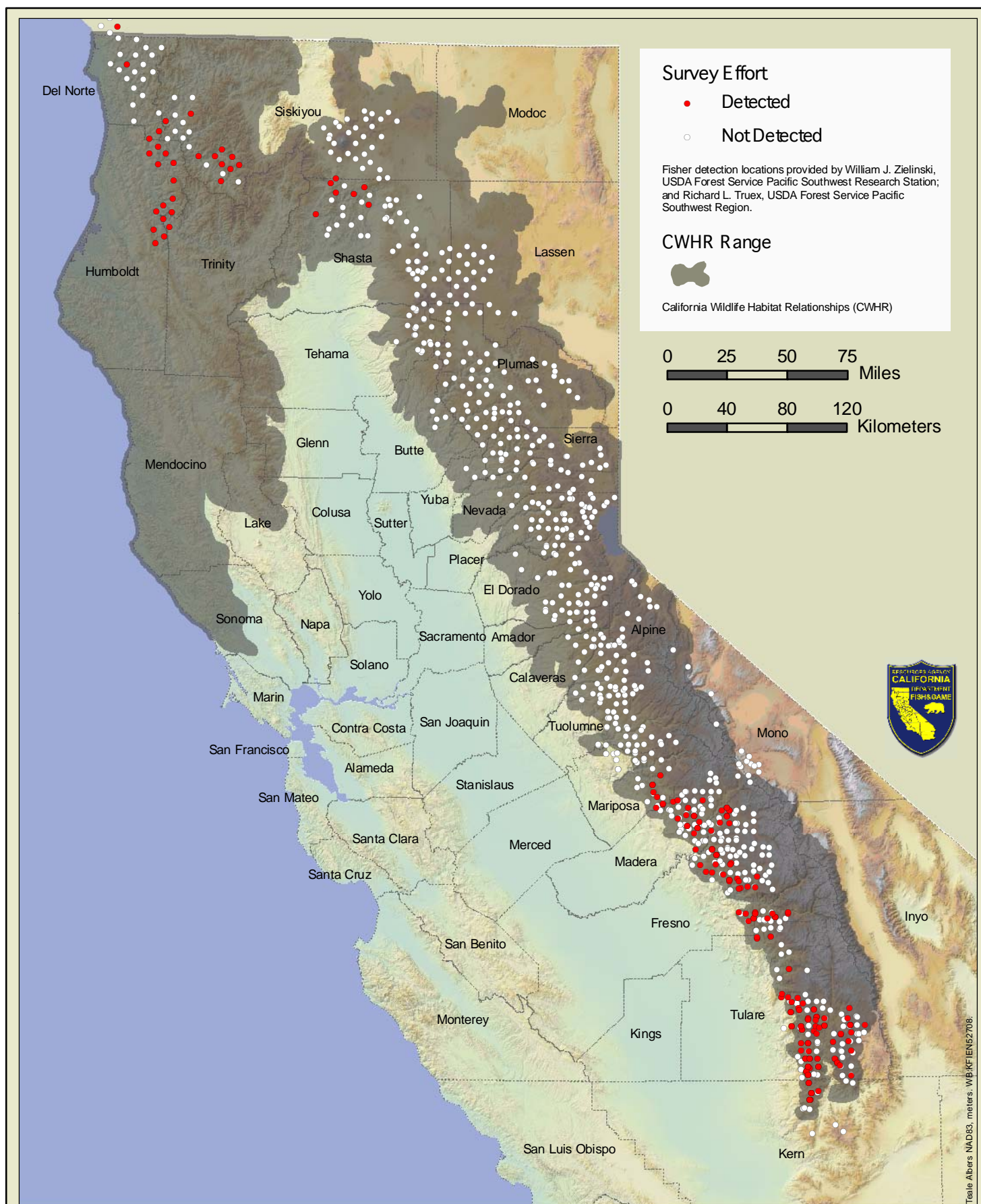


Figure 4. DISTRIBUTION OF FISHERS ON PUBLIC LAND IN CALIFORNIA, 1996-2005  
Based on track-plate and camera surveys conducted on federal lands

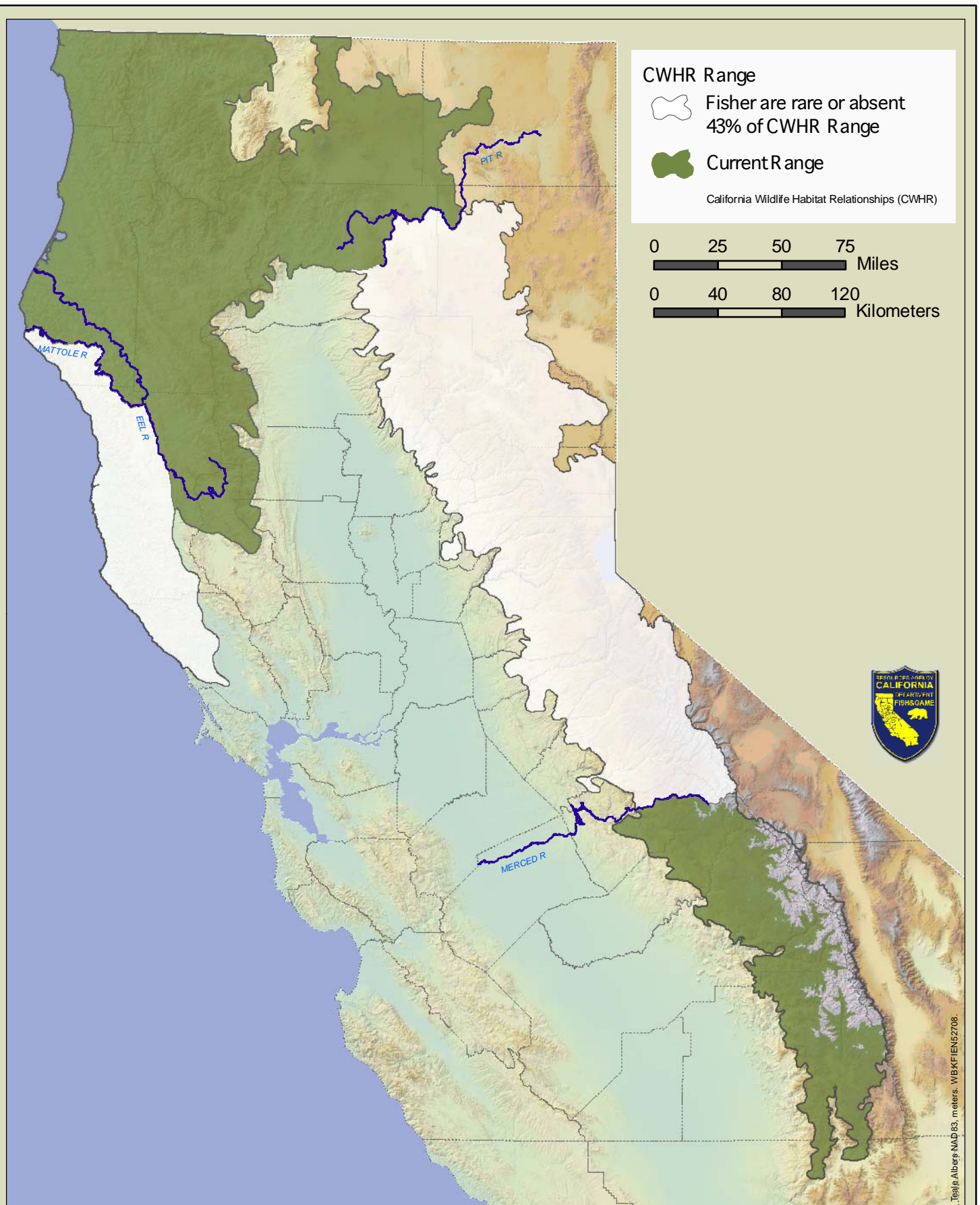


Figure 5. AREAS IN CALIFORNIA WHERE FISHER ARE NOW RARE OR ABSENT, TOTALLING APPROXIMATELY 43% OF HISTORIC RANGE



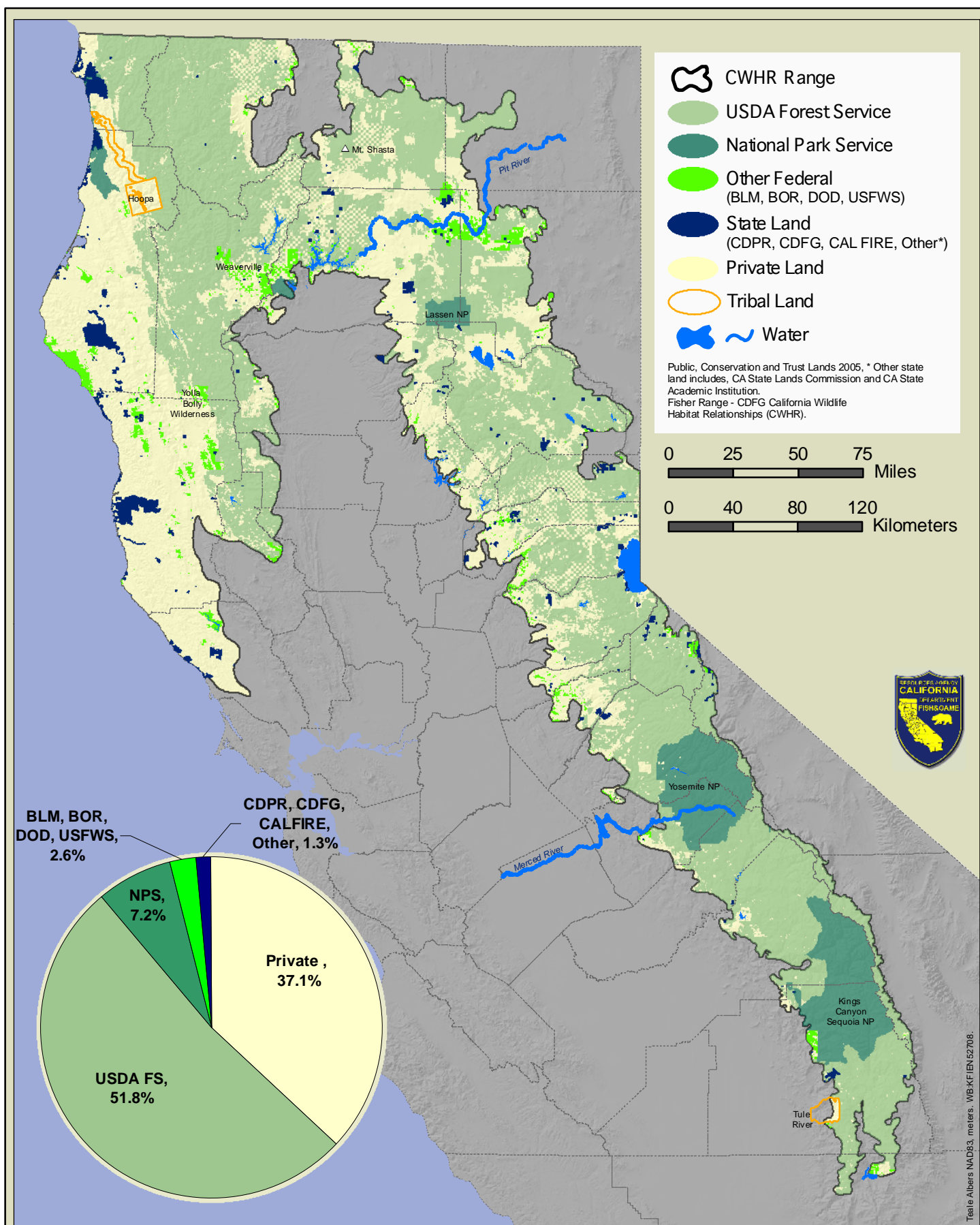


Figure 6. LAND OWNERSHIP WITHIN FISHER (*MARTES PENNANTI*) RANGE



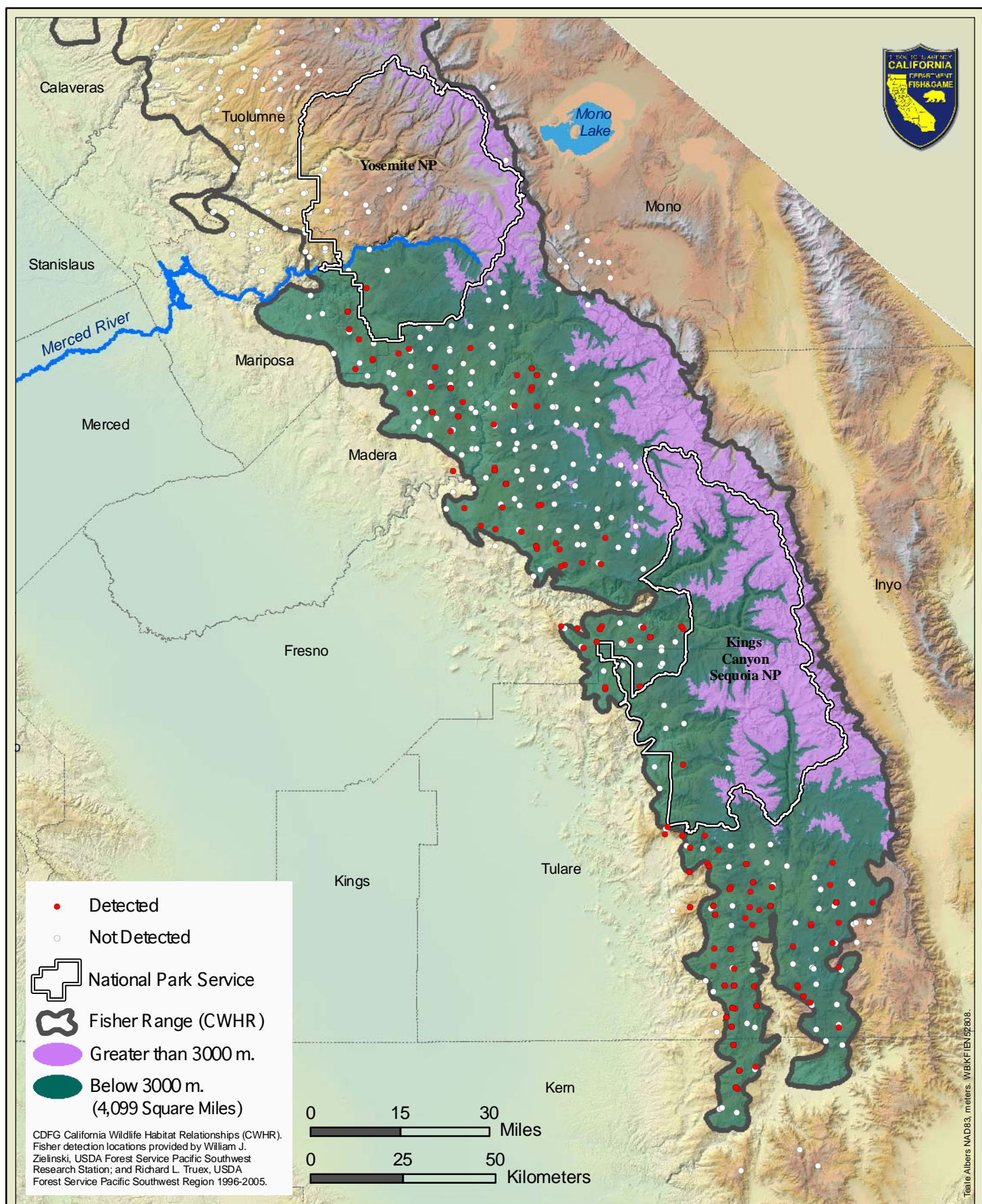
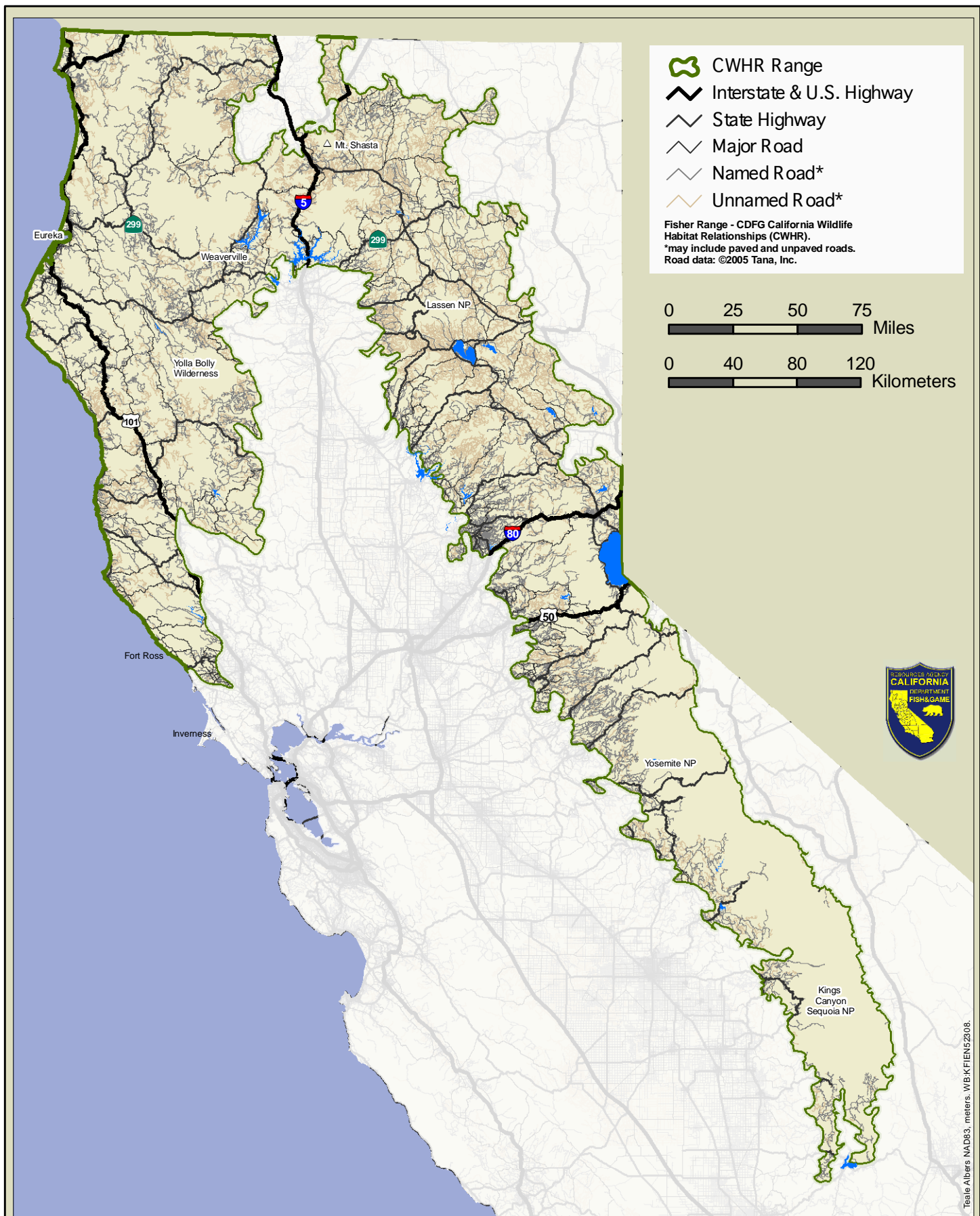


Figure 7. RANGE OF FISHER IN RELATION TO YOSEMITE AND KINGS CANYON SEQUOIA NATIONAL PARKS, 1996 - 2005, based on track-plate and camera surveys conducted on federal lands, (see also Figure 4).





**Figure 8. CALIFORNIA ROADWAYS IN FISHER RANGE**  
 (includes U.S. Highways, Interstates, major and minor roads).





**Figure 9.** Radio-collared female fisher at a rest site on Hoopa Tribal land; the rest tree is a black oak (*Quercus kelloggii*).

*Photo by: Rebecca Green*





**Figure 10.** Natal den site for fisher on Hoopa Tribal land; the den tree is a tan oak (*Lithocarpus densiflora*), and the diameter of the cavity measured 7.5 cm horizontal x 6.5 cm vertical.

*Photos by: Mark Higley*



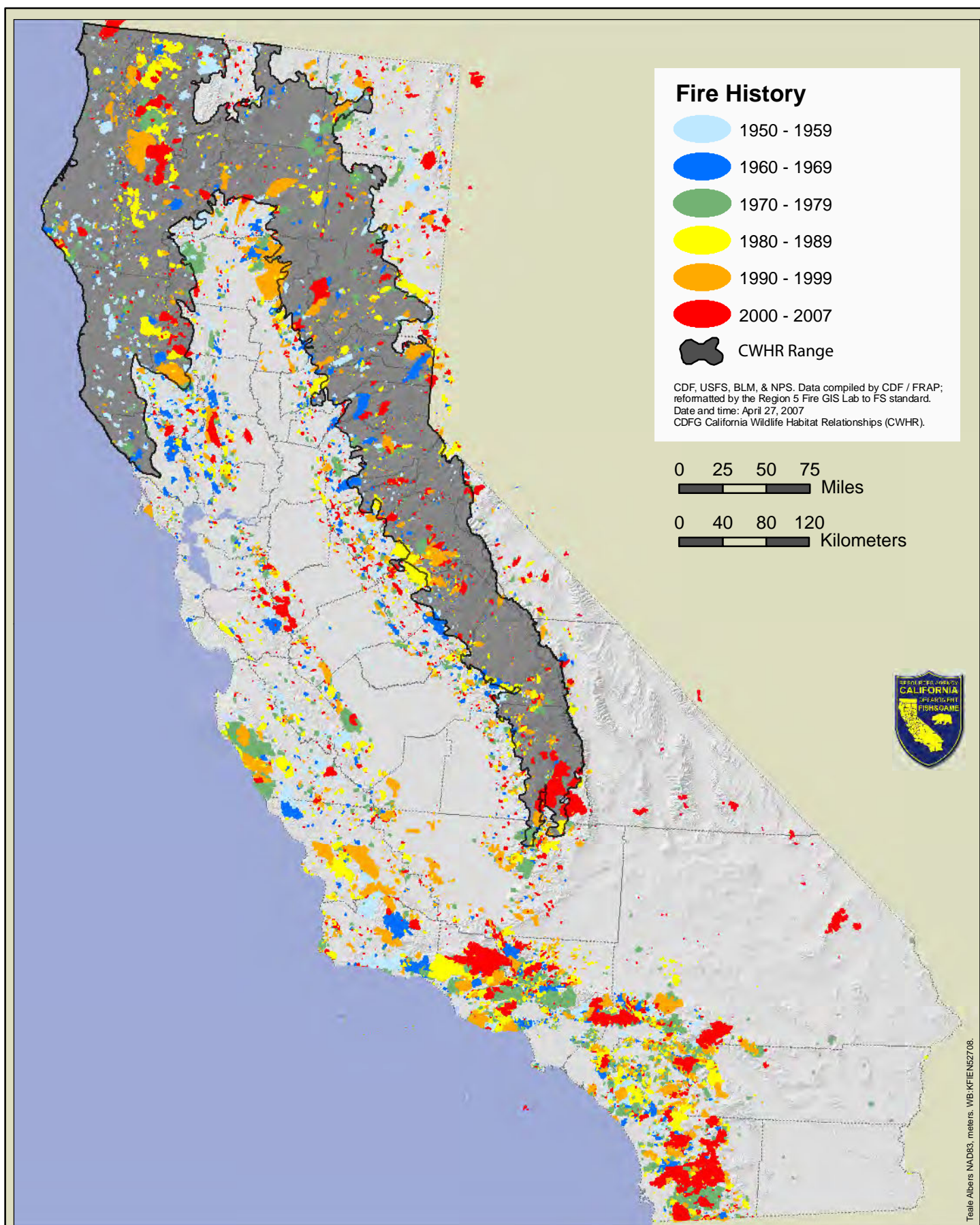


Figure 11. Perimeters of wildfires from the period of 1950 to 2006 sourced from USDA Forest Service data (perimeters  $\geq 10$  acres) and CAL FIRE data (perimeters  $\geq 300$  acres).

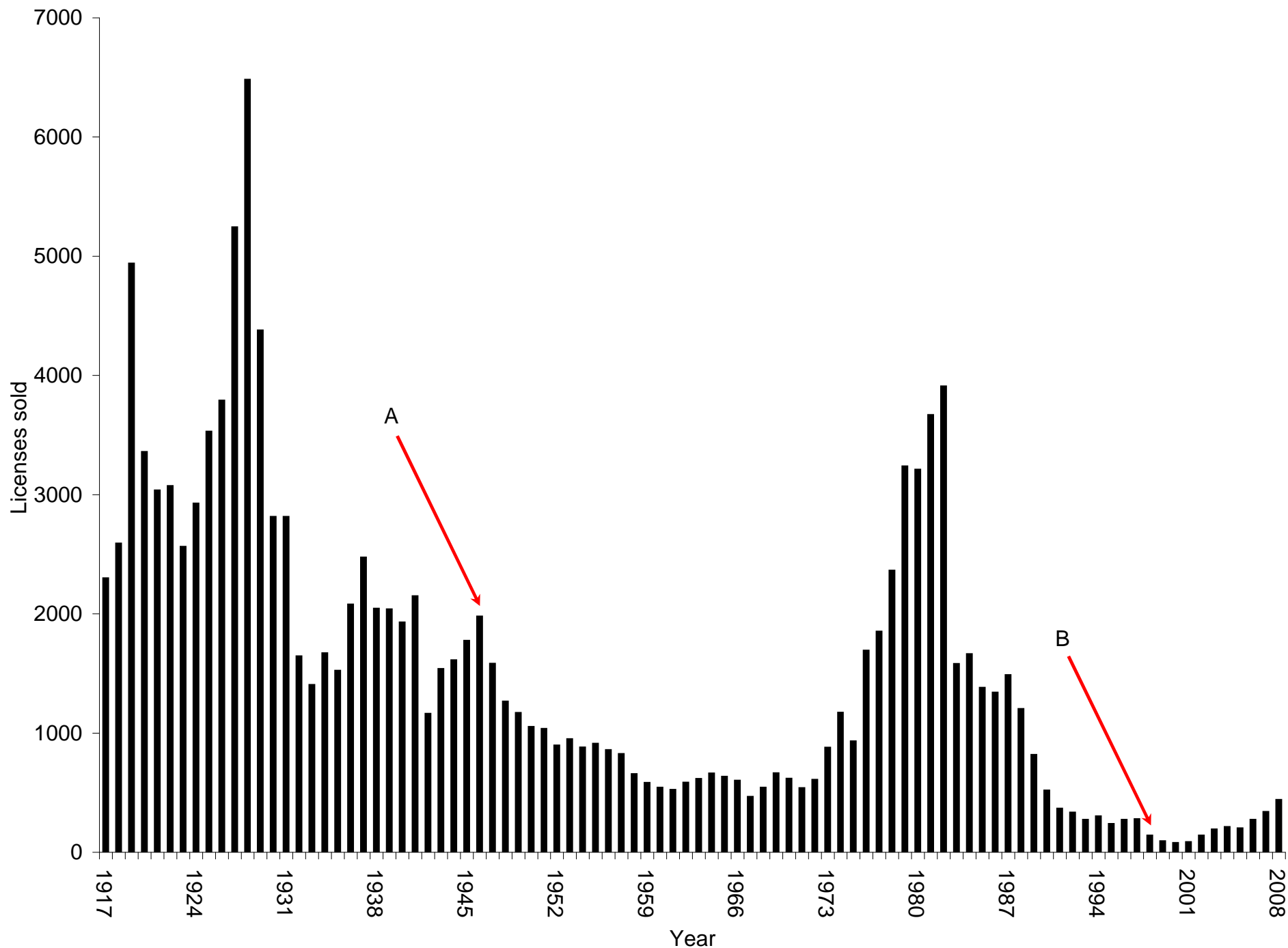


Figure 12. Number of trapping licenses sold in California from 1917-2008. Statewide ban on fisher trapping in 1946 is designated by "A". Statewide ban on body-gripping traps in 1998 is designated by "B".

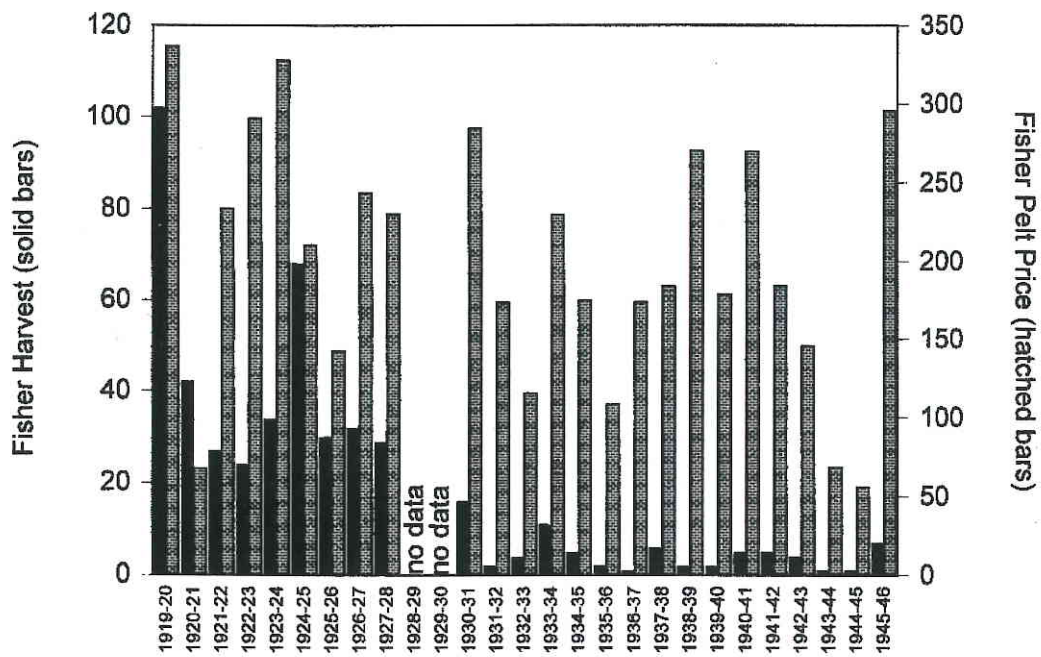
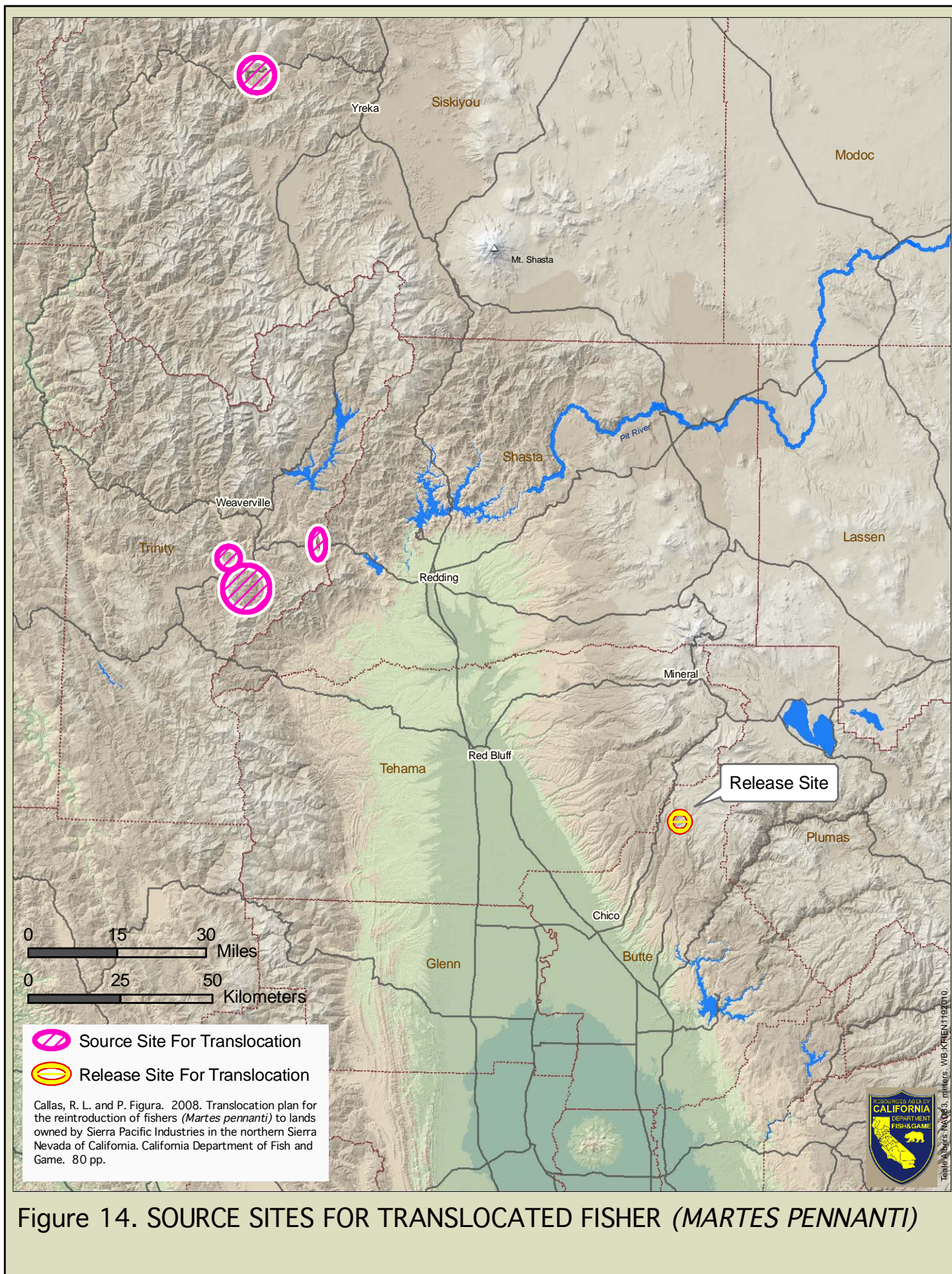


Figure 13. Number of fisher pelts harvested and the mean price paid (adjusted for inflation) for fisher pelts in California, 1919-1946 (from Lewis and Zielinski 1996, used by permission).





# **Appendix A**

## Public Notice





**PUBLIC NOTICE**  
**June 26, 2009**

**TO WHOM IT MAY CONCERN:**

Pursuant to Section 2074.4 of the California Fish and Game Code (FGC), **NOTICE IS HEREBY GIVEN** that on March 4, 2009, the California Fish and Game Commission accepted for consideration the petition submitted to list the Pacific fisher (*Martes pennanti*) as threatened or endangered (Section 670.1, 670.5, Title 14, California Code of Regulations) as follows:

<u>Species</u>	<u>Proposal</u>
Pacific fisher ( <i>Martes pennanti</i> )	List as Threatened or Endangered

The California Endangered Species Act (FGC, Chapter 1.5, Section 2050 *et seq.*) requires that the Department of Fish and Game notify affected and interested parties that the Commission has accepted the petition for the purpose of receiving information and comments that will aid in evaluating the petition and determining whether or not the above proposal should be adopted or rejected by the Commission. The Commission's March 4, 2009 action has resulted in this species receiving the interim designation of "candidate species", effective April 24, 2009, under the California Endangered Species Act. The Department has 12 months to review the petition, evaluate the available information, and report back to the Commission whether or not the petitioned action is warranted (FGC 2074.6). The Department's recommendation must be based on the best scientific information available to the Department.

Therefore, **NOTICE IS FURTHER GIVEN** that anyone with data or comments on the taxonomic status, ecology, biology, life history, management recommendations, distribution, abundance, threats, habitat that may be essential for the species, or other factors related to the status of the above species, is hereby requested to provide such data or comments to:

California Department of Fish and Game  
Nongame Wildlife Program  
Attn: Ms. Esther Burkett  
1812 9<sup>th</sup> Street  
Sacramento, California 95811

Submit 3 hard copies and a digital copy. Comments may also be sent via email to:  
[fishercomments@dfg.ca.gov](mailto:fishercomments@dfg.ca.gov)

Fisher occurrence information should be sent directly to the California Natural Diversity Database (CNDDB). Verifiable information is preferred, and documentation should be thorough. See general data submittal instructions at this link or contact CNDDB staff directly: <http://www.dfg.ca.gov/biogeodata/cnddb/>

Responses received by **August 21, 2009** will be included in the Department's final report to the Fish and Game Commission. If the Department concludes that the petitioned action is warranted, it will recommend that the Commission adopt the proposal. If the Department concludes that the petitioned action is not warranted, it will recommend that the Commission reject the proposal. Following the receipt of the Department's report, the Commission will allow a 30-day public comment period prior to taking any action on the Department's recommendation.

If you have any questions, please contact Ms. Esther Burkett, Staff Environmental Scientist, by telephone at (916) 445-3764 or by email at [eburkett@dfg.ca.gov](mailto:eburkett@dfg.ca.gov).



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Arlene	Kosic	Bureau of Land Management	1695 Heindon Road	Arcata	CA	95521
Mike	Pool	Bureau of Land Management	2800 Cottage Wy., Ste. W-1623	Sacramento	CA	95825
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Werner	Harold	Sequoia & Kings Canyon National Parks	47050 Generals Highway	Three Rivers	CA	93271
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Jay	Harris	CA Dept of Parks and Recreation, North Coast Redwoods Dis	P.O. Box 2006	Eureka	CA	95502
Crawford	Tuttle	Cal Fire	1416 Ninth Street	Sacramento	CA	95814
George	Gentry	Board of Forestry	1416 Ninth St., Rm. 1506-14	Sacramento	CA	95814
Will	Kempton	Caltrans	1120 N Street	Sacramento	CA	95814
Randell	Iwasaki	Caltrans	1120 N Street	Sacramento	CA	95814
Jay	Norvell	Caltrans	1120 N Street	Sacramento	CA	95814
Jay	Erickson	Caltrans	1120 N Street	Sacramento	CA	95814
John	Buckley	Central Sierra Environmental Resource Center	P.O. Box 396	Twain Harte	CA	95383
Patrick	Emmert	Southern California Edison Company	P.O. Box 600	Shaver Lake	CA	93664
Dave	Goehring	Pacific Gas & Electric Company	127 East Main Street	Grass Valley	CA	95945
Richard	Higgenbottom	Humboldt Redwood Co.	P.O. Box 712	Scotia	CA	95565
Mike	Jani	Humboldt Redwood Co.	P.O. Box 712	Scotia	CA	95565
Sal	Chinnici	Humboldt Redwood Co.	P.O. Box 712	Scotia	CA	95565
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Robert	Douglas	Mendocino Redwood Co.	P.O. Box 489	Fort Bragg	CA	95437
Sarah	Billig	Mendocino Redwood Co.	P.O. Box 996	Ukiah	CA	95482
Lowell	Diller	Green Diamond	P.O. Box 68	Korbel	CA	95550
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Doug	Meekins	Campbell Timberland Management	P.O. Box 1228	Ft. Bragg	CA	95437
Stephen	Levesque	Campbell Timberland Management	P.O. Box 1228	Ft. Bragg	CA	95437
Henry	Alden	Gualala Redwoods	P.O. Box 197	Gualala	CA	95445
Charlie	Brown	Fruitgrowers	1216 Fruit Growers Rd	Hilt	CA	96044

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Mark	Higley	Hoopa Tribe	P.O. Box 368	Hoopa	CA	95546
Maria	Tripp	Yurok Tribe, Klamath Office	190 Klamath Blvd	Klamath	CA	95548
Roland	Raymond	Yurok Tribe, Klamath Office	190 Klamath Blvd	Klamath	CA	95548
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Craig	Thompson	U.S. Forest Service Sierra Nevada Research Center	2081 E. Sierra Avenue	Fresno	CA	93710
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		Environmental Protection Information Center	854 9th Street	Arcata	CA	95521
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Keith D.	Hess	Timberland Resource Consultants	165 South Fortuna Blvd., Ste. 4	Fortuna	CA	95540
Lawrence	Groth		2516 Blanding Avenue	Alameda	CA	94501
Keith	Garner	Sheppard Mullin	4 Embarcadero Center, 17th Fl.	San Francisco	CA	94111
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Steve	Shaffer, Direct	USDA Office of Agricultural and Environmental Stewardship	1220 N Street, Room A-400	Sacramento	CA	95814
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Paul	Spitler	Center for Biological Diversity	P.O. Box 2175	Bend	OR	97709
Steven	Self	Sierra Pacific Industries Forestry Division	P.O. Box 496014	Redding	CA	96049
Steve	Henson	Roseburg Resources Co.	98 Mill Street	Weed	CA	96094
Stuart	Farber	Timber Products Co.	130 South Phillipe Lane	Yreka	CA	96097
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Justin	Augustine	Center for Biological Diversity	351 California Street, Ste. 600	San Francisco	CA	94104
Mark	Pawlicki	Sierra Pacific Industries	P.O. Box 496028	Redding	CA	96049
Thomas E.	Kucera Ph.D.		22 Reservoir Road	San Rafael	CA	94901
David E.	Moser	Ebbin Moser & Skaggs LLP	550 Montgomery St., Ste. 900	San Francisco	CA	94111
Pamela	Flick	Defenders of Wildlife	1303 J Street, #270	Sacramento	CA	95814
Walt	Mansell	California Rifle and Pistol Association	PO Box 623	Red Bluff	CA	96080
Michelle	Dias	California Forestry Association	1215 K Street, Suite 1830	Sacramento	CA	95814
Gary	Rynearson	Green Diamond Resource Company	PO Box 68	Korbel	CA	9550
J Scott	Yaeger	US Fish and Wildlife Service, Yreka Office	1829 S. Oregon Street	Yreka	CA	96097

ADDRESSEE	COUNTY	ADDRESS	
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SIMMS, BOB		1401 LOWER LAKE RD	PLACERVILLE, CA 95667
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BOARD OF SUPERVISORS	COUNTY OF ALPINE	PO BOX 158	MARKLEEVILLE CA 96120
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BOARD OF SUPERVISORS	COUNTY OF CALAVERAS	GOVERNMENT CENTER 891 MOUNTAIN RANCH RD	SAN ANDREAS CA 95249
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BOARD OF SUPERVISORS	COUNTY OF CONTRA COSTA	651 PINE ST RM 106	MARTINEZ CA 94553
BOARD OF SUPERVISORS	COUNTY OF DEL NORTE	981 H STREET, SUITE 200	CRESCENT CITY CA 95531
BOARD OF SUPERVISORS	COUNTY OF EL DORADO	330 FAIR LANE	PLACERVILLE CA 95667
BOARD OF SUPERVISORS	COUNTY OF FRESNO	2281 TULARE ST HALL OF RECORDS 301	FRESNO CA 93721
BOARD OF SUPERVISORS	COUNTY OF GLENN	PO BOX 391	WILLOWS CA 95988
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BOARD OF SUPERVISORS	COUNTY OF IMPERIAL	940 W MAIN ST SUITE 202	EL CENTRO CA 92243
BOARD OF SUPERVISORS	COUNTY OF INYO	PO BOX N	INDEPENDENCE CA 93526
BOARD OF SUPERVISORS	COUNTY OF KERN	1115 TRUXTUN AVE 5TH FLOOR	BAKERSFIELD CA 93301
BOARD OF SUPERVISORS	COUNTY OF KINGS	1400 W LACEY BLVD	HANFORD CA 93230
BOARD OF SUPERVISORS	COUNTY OF LAKE	255 N FORBES ST	LAKEPORT CA 95453
BOARD OF SUPERVISORS	COUNTY OF LASSEN	221 S. ROOP STREET SUITE 4	SUSANVILLE CA 96130
BOARD OF SUPERVISORS	COUNTY OF LOS ANGELES	500 WEST TEMPLE ST SUITE 383	LOS ANGELES CA 90012
BOARD OF SUPERVISORS	COUNTY OF MADERA	200 W 4TH STREET	MADERA CA 93637
BOARD OF SUPERVISORS	COUNTY OF MARIN	3501 CIVIC CENTER DR ROOM 329	SAN RAFAEL CA 94903
BOARD OF SUPERVISORS	COUNTY OF MARIPOSA	PO BOX 784	MARIPOSA CA 95338
BOARD OF SUPERVISORS	COUNTY OF MENDOCINO	501 LOW GAP ROAD RD ROOM 1090	UKIAH CA 95482
BOARD OF SUPERVISORS	COUNTY OF MERCED	2222 M ST	MERCED CA 95340
BOARD OF SUPERVISORS	COUNTY OF MODOC	204 S. COURT STREET	ALTURAS CA 96101
BOARD OF SUPERVISORS	COUNTY OF MONO	PO BOX 715	BRIDGEPORT CA 93517
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BOARD OF SUPERVISORS	COUNTY OF NAPA	1195 THIRD ST RM 310	NAPA CA 94559
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BOARD OF SUPERVISORS	COUNTY OF ORANGE	333 W SANTA ANA BLVD	SANTA ANA CA 92701
BOARD OF SUPERVISORS	COUNTY OF PLACER	175 FULWEILER AVE	AUBURN CA 95603
BOARD OF SUPERVISORS	COUNTY OF PLUMAS	520 MAIN ST RM 201	QUINCY CA 95971
BOARD OF SUPERVISORS	COUNTY OF RIVERSIDE	4080 LEMON ST ADMIN CENTER	RIVERSIDE CA 92501
BOARD OF SUPERVISORS	COUNTY OF SACRAMENTO	700 H ST RM 2450	SACRAMENTO CA 95814
BOARD OF SUPERVISORS	COUNTY OF SAN BENITO	481 FOURTH STREET	HOLLISTER CA 95023
BOARD OF SUPERVISORS	COUNTY OF SAN BERNARDINO	385 N ARROW HEAD AVE	SAN BERNARDINO CA 94215

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BOARD OF SUPERVISORS	COUNTY OF SAN JOAQUIN	222 E WEBER AVE	STOCKTON CA 95202
BOARD OF SUPERVISORS	COUNTY OF SAN LUIS OBISPO	COUNTY GOVERNMENT CENTER RM 370	SAN LUIS OBISPO CA 93408
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BOARD OF SUPERVISORS	COUNTY OF SANTA BARBARA	105 E ANAPAMU ST	SANTA BARBARA CA 93101
BOARD OF SUPERVISORS	COUNTY OF SANTA CLARA	70 WEST HEDDING ST	SAN JOSE CA 95110
BOARD OF SUPERVISORS	COUNTY OF SANTA CRUZ	701 OCEAN ST RM 500	SANTA CRUZ CA 95060
BOARD OF SUPERVISORS	COUNTY OF SHASTA	1450 COURT ST STE 308B	REDDING CA 96001-1680
BOARD OF SUPERVISORS	COUNTY OF SIERRA	PO BOX D	DOWNIEVILLE CA 95936
BOARD OF SUPERVISORS	COUNTY OF SISKIYOU	PO BOX 750	YREKA CA 96097
BOARD OF SUPERVISORS	COUNTY OF SOLANO	675 TEXAS ST STE 6500	FAIRFIELD CA 94533
BOARD OF SUPERVISORS	COUNTY OF SONOMA	575 ADMINISTRATION DR RM 100A	SANTA ROSA CA 95403
BOARD OF SUPERVISORS	COUNTY OF STANISLAUS	1010 TENTH STREET STE 6500	MODESTO CA 95354
BOARD OF SUPERVISORS	COUNTY OF SUTTER	1160 CIVIC CENTER BLVD	YUBA CITY CA 95993
BOARD OF SUPERVISORS	COUNTY OF TEHAMA	PO BOX 250	RED BLUFF CA 96080
BOARD OF SUPERVISORS	COUNTY OF TRINITY	PO BOX 1613	WEAVERVILLE, CA 96093-1613
BOARD OF SUPERVISORS	COUNTY OF TULARE	2800 W BURREL AVE	VISALIA CA 93291
BOARD OF SUPERVISORS	COUNTY OF TUOLUMNE	2 SOUTH GREEN ST	SONORA CA 95370
BOARD OF SUPERVISORS	COUNTY OF VENTURA	800 SOUTH VICTORIA AVE	VENTURA CA 93009
BOARD OF SUPERVISORS	COUNTY OF YOLO	625 COURT ST RM 204	WOODLAND CA 95695
BOARD OF SUPERVISORS	COUNTY OF YUBA	915 8TH STREET STE 109	MARYSVILLE CA 95901

ADDRESSEE	COUNTY	AGENCY	ADDRESS			
Sheriff Herbert Walters	Alameda	Fish and Game Commission	4985 Broder Blvd.	Dublin	CA	94568
	Alpine	Fish and Game Commission	P.O. Box 266	Markleeville	CA	96120
Mr. Dennis Hood	Calaveras	Fish and Game Commission	891 Countain Ranch Rd.	San Andreas	CA	95244
	Colusa	Fish and Game Commission	546 J Street	Colusa	CA	95932
	Contra Costa	Fish and Game Commission	651 Pine Street, NW 4th St.	Martinez	CA	95553
	Del Norte	Fish and Game Commission	586 G Street	Crescent City	CA	95531
Mr. Karl Weiland	El Dorado	Fish and Game Commission	330 Fair Lane	Placerville	CA	95667
Mr. Dale Tartaglia	Fresno	Fish & Wildlife Commission	2220 Tulare Street, Ste. 1600	Fresno	CA	93721
Ms. Johanna Rodoni	Humboldt	Fish and Game Commission	P.O. Box 922	Ferndale	CA	95536
	Imperial	Fish and Game Commission	1002 State Street	El Centro	CA	92243
Ms. Vicki Russell	Inyo and Mono	Fish and Game Advisory Commission	373 Hammil Road	Hammil Valley	CA	93514
Mr. David McArther	Kern	Fish and Game Fine Commission	1110 Golden State Avenue	Bakersfield	CA	93301
Mr. Kevin Loewen	Kings	Fish and Game Advisory Committee	1400 W Lacey Blvd	Hanford	CA	93230
Mr. Greg Giusti	Lake	Fish and Game Commission	883 Lakeport	Lakeport	CA	95453
Mr. Rob Hill	Lassen	Fish and Game Commission	707 Nevada Street	Susanville	CA	96130
	Los Angeles	Fish and Game Commission	500 West Temple St., RM 383	Los Angeles	CA	90012
Mr. Neil K. McDougal	Madera	Fish and Game Commission	46089 Road 208	Friant	CA	93626
Mr. Ed Schultz	Marin	Fish and Wildlife Advisory Committee	1682 Novato Blvd. Ste. 150 B	Novato	CA	94947
Mr. Craig Bell	Mendocino	Fish and Game Commission	501 Low Gap Rd	Ukiah	CA	95482
Mr. Rich Hewitt	Monterey	Fish and Game Commission	P.O. Box 5249	Salinas	CA	93915
Mr. Stephen Rae	Napa	Fish Conservation Commission	1195 Third Street., Ste. 210	Napa	CA	94559
	Nevada	Fish and Game Commission	255 South Aburn Street	Grass Valley	CA	95943
	Orange	Fish and Game Commission	PO Box 4048	Santa Ana	CA	92702
	Placer	Fish and Game Commission	8459 Lakeland Dr	Granit Bay	CA	95746
Mr. Jim Real	Riverside	Fish and Game Commission	4600 Crestmore Road	Riverside	CA	92509
Mr. Dan Gonzales	Sacramento	Fish and Game Commission	3711 Branch Center Road	Sacramento	CA	95827
c/o Clerk of the Board	San Benito	Fish and Game Commission	481 Fourth Street	Hollister	CA	95023
	San Bernardino	Fish and Game Commission	157 West 5th Street, 2nd Floor	San Bernardino	CA	92415
	San Diego	Fish and Game Commission	5555 Overland Ave., Bldg. # 3	San Diego	CA	92123
Mr. Norm Martignoni	San Luis Obispo	Fish and Game Commission	PO. Box 406	Morro Bay	CA	93443
Mr. John Kolski	Santa Clara	Fish and Game Commission	70 West Hedding Street	San Jose	CA	95110
Ms. Kristen Kittleson	Santa Cruz	Fish and Game Commission	701 Ocean Street, Rm. 312	Santa Cruz	CA	95060
Ms. Sue Crowe	Shasta	Fish and Game Commission, c/o Public Works	1855 Placer Street	Redding	CA	96001
Mr. Jim Colin	Shasta	Fish and Game Commission, c/o Public Works	1856 Placer Street	Redding	CA	96002
Ms. Marilyn Tierney	Sierra	Fish and Game Commission	P.O. Box 554	Downieville	CA	95936

ADDRESSEE	COUNTY	AGENCY	ADDRESS				
Mr. Steve Hermsmeyer	Solano	Fish and Game Commission	675 Texas Street, Ste. 2500	Fairfield	CA	94533	
Ms. Crystal Norris	Sonoma	Fish and Wildlife Commission	133 Aviation Blvd., Ste. 110	Santa Rosa	CA	95403	
Dr. Ed Channing	Stanislaus	Fish and Game Fine Commission	1115 Sierra Drive	Turlock	CA	95380	
	Sutter	Fish and Game Commission	1160 Civic Center Blvd.	Yuba City	CA	95993	
	Tehama	Fish and Game Commission	15565 China Repids Drive	Red Bluff	CA	96080	
	Trinity	Fish and Game Commission	PO Drawer 1258	Weaverville		96093	
Mr. Bud Baker	Tuolumne	Fish and Game Commission	18036 Blue Bell East	Sonora	CA	95370	
Alan Sanders	Ventura	Fish and Game Commission	232 N. 3rd Street	Port Hueneme	CA	93041	
	Yolo	Parks and Resources Dept.	120 West Main Street, Suite C	Woodland	CA	95695	



## PUBLIC NOTICE September 2, 2009

### TO WHOM IT MAY CONCERN:

Pursuant to Section 2074.4 of the California Fish and Game Code (FGC), **NOTICE IS HEREBY GIVEN** that on March 4, 2009, the California Fish and Game Commission accepted for consideration the petition submitted to list the Pacific fisher (*Martes pennanti*) as threatened or endangered (Section 670.1, 670.5, Title 14, California Code of Regulations) as follows:

Species

Pacific fisher  
(*Martes pennanti*)

Proposal

List as Threatened or Endangered

The California Endangered Species Act (FGC, Chapter 1.5, Section 2050 *et seq.*) requires that the Department of Fish and Game notify affected and interested parties that the Commission has accepted the petition for the purpose of receiving information and comments that will aid in evaluating the petition and determining whether or not the above proposal should be adopted or rejected by the Commission. The Commission's March 4, 2009 action has resulted in this species receiving the interim designation of "candidate species", effective April 24, 2009, under the California Endangered Species Act. The Department has 12 months to review the petition, evaluate the available information, and report back to the Commission whether or not the petitioned action is warranted (FGC 2074.6). The Department's recommendation must be based on the best scientific information available to the Department.

Therefore, **NOTICE IS FURTHER GIVEN** that anyone with data or comments on the taxonomic status, ecology, biology, life history, management recommendations, distribution, abundance, threats, habitat that may be essential for the species, or other factors related to the status of the above species, is hereby requested to provide such data or comments to:

California Department of Fish and Game  
Nongame Wildlife Program  
Attn: Ms. Esther Burkett  
1812 9<sup>th</sup> Street  
Sacramento, California 95811

Submit 3 hard copies and a digital copy. Comments may also be sent via email to:  
[fishercomments@dfg.ca.gov](mailto:fishercomments@dfg.ca.gov).

Fisher occurrence information should be sent directly to the California Natural Diversity Database (CNDDDB). Verifiable information is preferred, and documentation should be thorough. See general data submittal instructions at this link or contact CNDDDB staff directly: [www.dfg.ca.gov/biogeodata/cnddb](http://www.dfg.ca.gov/biogeodata/cnddb).

Responses received by **October 2, 2009** will be included in the Department's final report to the Fish and Game Commission. If the Department concludes that the petitioned action is warranted, it will recommend that the Commission adopt the proposal. If the Department concludes that the petitioned action is not warranted, it will recommend that the Commission reject the proposal. Following the receipt of the Department's report, the Commission will allow a 30-day public comment period prior to taking any action on the Department's recommendation.

If you have any questions, please contact Ms. Esther Burkett, Staff Environmental Scientist, by telephone at (916) 445-3764 or by email at [eburkett@dfg.ca.gov](mailto:eburkett@dfg.ca.gov).



## **California Department of Fish and Game News Release**

**Date:** September 3, 2009

**Contact:** Esther Burkett, Wildlife Branch, (916) 445-3764  
Kirsten Macintyre, DFG Communications, (916) 322-8988

### **DFG Invites Public Comment Related to Pacific Fisher**

The California Department of Fish and Game (DFG) is seeking public comment on a proposal to list the Pacific fisher as an endangered or threatened species.

Fishers (*Martes pennanti*) are medium-sized forest carnivores that are in the same family as mink, weasels and otters. In California, they live in forested regions including portions of the Sierras, Cascades, Klamath Province, north coast redwoods and the Mendocino National Forest. Habitat loss, habitat modification, forest fragmentation and trapping for fur (up until 1945) are considered to be the main factors that affect the fisher population in California.

The Pacific fisher is currently considered a "species of special concern." In January 2008, the Center for Biological Diversity submitted a petition to the Fish and Game Commission to formally list the fisher as a threatened or endangered species. As part of the status review process, DFG is soliciting public comment regarding the fisher's taxonomic status, ecology, biology, life history, distribution, abundance, threats, habitat that may be essential for the species, and recommendations for management.

Comments, data and other information must be submitted in writing to:

California Department of Fish and Game  
Nongame Wildlife Program  
Attn: Esther Burkett  
1812 9th Street  
Sacramento, CA 95811

Comments may also be submitted by email to: [fishercomments@dfg.ca.gov](mailto:fishercomments@dfg.ca.gov). All comments received by October 2, 2009 will be included in a DFG report to the Commission that will be submitted no later than April 23, 2010. Another 30-day public comment period will be held before the Commission makes its decision, which could occur as soon as August 2010.

DFG's petition evaluation report for the Pacific fisher can be found at:

<http://www.dfg.ca.gov/wildlife/nongame/publications/>.

## Appendix B

### Peer Review

Keith B. Aubry, Ph.D.  
Research Wildlife Biologist  
USFS Pacific Northwest Research Station  
Forestry Sciences Laboratory  
Olympia, Washington

Reginald H. Barrett, Ph.D.  
Professor of Wildlife Management  
University of California, Berkeley  
Berkeley, CA

Richard T. Golightly, Ph.D.  
Professor, Wildlife Department  
Humboldt State University  
Arcata, CA

Malcolm North, Ph.D.  
Associate in Forest Ecology  
USFS Pacific Southwest Research Station  
Sierra Nevada Research Center  
Davis, CA

William J. Zielinski, Ph.D. (Comments were received verbally)  
Research Ecologist  
Pacific Southwest Research Station  
Redwood Sciences Laboratory  
Arcata, CA



**File Code:** 4200

**Date:** January 30, 2010

Ms. Esther Burkett  
California Department of Fish and Game  
Wildlife Branch, Nongame Wildlife Program  
1812 Ninth Street  
Sacramento, CA. 95811

Dear Esther,

As requested, here are my review comments on the draft Status Review of the Fisher in California dated January 23, 2010, that was prepared by the California Department of Fish and Game. As you know, I received the Status Review and related documents earlier this week, and was given less than a week to provide technical review comments. Due to other commitments on my time during this week, I only had a portion of the last few days in which to conduct my review. Consequently, I did not have time to read the petition that was submitted by the Center for Biological Diversity in January 2008, nor to spend much time looking at the Appendices. Accordingly, the comments that I am able to provide on the scientific content of the draft Status Review result from a fairly cursory review of the document.

My qualifications as a technical reviewer of this document are as follows: I am a Research Wildlife Biologist with the Pacific Northwest Research Station of the U.S. Forest Service in Olympia, Washington. I've been conducting research on terrestrial wildlife in Washington and Oregon for over 30 years and, during the last 10 years, have been involved in synthetic research conducted at both continental and global scales. During the latter time period, most of my research has been directed at improving our understandings of the phylogeography, current and historical distribution, conservation genetics, and ecological relations of rare, secretive, and potentially threatened forest carnivores, including the fisher, Canada lynx, wolverine, and montane red fox (e.g., the Sierra Nevada red fox). I have been involved in numerous research and conservation efforts for the fisher in the Pacific coastal portion of its range, including conducting a 5-year radio-telemetry study of fishers in the southern Oregon Cascade Range, serving on the Scientific Advisory Committee for the reintroduction of fishers to Washington state, and leading the Fisher Science Team, which provides consultation and advice to the interagency West Coast Fisher Steering Committee and Biology Team, who are developing a conservation assessment and strategy for the fisher in the Pacific coastal states and provinces. I also served as Chairman of the Planning Committee for the 5<sup>th</sup> International Symposium on Martens, Sables, and Fishers that we recently convened in Seattle, Washington, and I will be the lead editor of the book we will publish from the proceedings of that symposium. In addition, I have published numerous peer-reviewed papers on the distribution, conservation genetics biology, and ecological relations of the fisher in western North America.



In general, I thought the draft Status Review was extremely well written and organized, and demonstrated an impressive amount of scholarship in both the published and unpublished literature. In addition, I thought the vast majority of interpretations and assessments made were appropriate, given the scientific information currently available, and reflected a good deal of careful thought and objective analyses. In short, I found no fatal flaws in the technical accuracy or completeness of this document.

My most substantive criticisms are in regard to assumptions made about the occurrence of fishers historically within the current gap in fisher distribution in the northern Sierra Nevada. As you have described in the section on Range and Distribution beginning on p. 9, Grinnell et al.'s (1937) range map depicting the distribution of point locations for fisher trapping records obtained from 1919 to 1924, shows a substantial gap in the distribution of those records in the northern Sierra Nevada. Grinnell et al. included this area within their delineation of the fisher's "assumed general range within past seventy-five years" (roughly 1862-1937), presumably because it appeared to contain suitable habitat conditions for fishers, even though they found no evidence of fisher occurrence in that area either during the 1920s or historically. At the top of page 13, you correctly admonish the reader to view anecdotal sighting reports with caution, and even quote a paper of mine on the importance of obtaining verifiable occurrence records for rare and elusive forest carnivores (Aubry and Jagger 2006), in which I wrote that such records "cannot be independently verified and are inherently unreliable". However, several lines down, you state, "...but we also recognize the value of sighting information provided by experienced/trained biologists, naturalists, foresters, and trappers.", and go on to state, "...we believe the majority of these occurrences are reliable and...help define the range of the species in California...". Based on those assumptions, you use the sighting reports presented by Schempf and White (1977) and more recent sighting reports compiled in agency wildlife observation databases (shown as pink dots in Figure 3) to conclude that the gap in fisher distribution records in the northern Sierras reported by Grinnell et al. was an historical anomaly, and that fishers were once distributed continuously throughout the Sierra Nevada.

First of all, I strongly disagree with your assessment of the value of sighting reports; not only does it contradict previous statements made about the problems associated with such records, but it is utterly lacking in empirical support. On the contrary, all available evidence that I'm aware of clearly shows that, regardless of the qualifications of the observer, sighting reports of rare and elusive species are inherently unreliable and should not be used for management or conservation purposes. Another paper on this subject that I co-authored (McKelvey et al. 2008) presents 3 examples of how the use of anecdotal observations in a conservation context resulted in serious errors regarding the presence, population dynamics, or range of the species in question. The 3 examples presented were (1) fishers in the Pacific coastal states, (2) the wolverine in California, and (3) the ivory-billed woodpecker in the southeastern U.S. As you know, the current gap in fisher distribution in the Sierras was not clearly recognized until biologists began conducting standardized surveys in the early 1990s using remote cameras and trackplate boxes that produce verifiable evidence of fisher occurrence. I.e., the anecdotal evidence that had been compiled for the Sierras prior to that time was unreliable and misleading (Aubry and Lewis 2003). However, the wolverine example is particularly applicable here, because it shows how the sighting reports

compiled by Schempf and White (1977) led the authors to conclude that wolverines occurred in most of the mountainous regions in California; furthermore, in 1978, the CDFG used their results to conclude that wolverine numbers were increasing in California when, in fact, they had most likely been extirpated from the state by the late 1920s (Aubry et al. 2007, Schwartz et al. 2007).

Second, the most reliable data we have on the historical distribution of fishers in California are the museum specimen and trapping records compiled by Grinnell et al. and others before the trapping season was closed in 1946. No documented record from this period was found in the Sierra Nevada within 100 km north or south of Lake Tahoe (Figure 3); thus, all “evidence” of fisher occurrence in the distributional “gap” in the northern Sierras are anecdotal sighting reports compiled after 1947. Consequently, if we are to believe that sighting reports from the northern Sierras obtained from 1947 to 1987 provide empirical evidence of fisher occurrence in that area historically, then we must also believe that (1) those populations were undetected by both biologists and trappers during the late 1800s and early 1900s, and (2) fishers were extirpated in that area sometime between 1947 and the era of standardized detection surveys that began in the early 1990s. I cannot accept that scenario. In my view, there is no empirical basis for concluding that fishers ever occurred in that area historically; we simply can’t be sure whether they did or they didn’t. However, recent genetic findings reported by Dr. Michael Schwartz that you summarized toward the bottom of page 6 provide important new insights into the distributional history of fishers in California. Dr. Schwartz analyzed genetic material from extant fisher populations in both northwestern California and the southern Sierra Nevada, and determined that these populations have been genetically isolated from each other for many thousands of years. Thus, these findings contradict the hypothesis that fishers were continuously distributed up and down the Sierras historically, and provide strong empirical support for the alternative hypothesis that the gap in fisher distribution in the northern Sierra Nevada documented by both Grinnell et al. (1937) and Zielinski et al. (1995) is not a recent artifact resulting from the modification of fisher habitat by humans but, rather, reflects a real gap in their historical distribution. The genetic analyses that Dr. Schwartz has conducted so far cannot tell us exactly where that gap was or how wide it may have been, but it clearly shows that the southern Sierra fisher population has been isolated from its northern counterpart for a very long time. Thus, I believe that all statements about the heuristic value of the anecdotal sighting reports included in your distribution maps need to be revised or eliminated, and that any assumptions made about the historical occurrence of fishers in the northern Sierra Nevada need to be revised to reflect a much greater degree of uncertainty than is included in the current draft.

#### Literature that was not already cited in the Status Review:

- Aubry, K.B., K.S. McKelvey, and J.P. Copeland. 2007. Distribution and broadscale habitat relations of the wolverine in the contiguous United States. *Journal of Wildlife Management* 71:2147-2158.
- McKelvey, K.S., K.B. Aubry, and M.K. Schwartz. 2008. Using anecdotal occurrence data for rare or elusive species: the illusion of reality and a call for evidentiary standards. *BioScience* 58:549-555.
- Schwartz, M.K., K.B. Aubry, K.S. McKelvey, K.L. Pilgrim, J.P. Copeland, J.R. Squires, R.M.

Inman, S.M. Wisely, and L.F. Ruggiero. 2007. Inferring geographic isolation of wolverines in California using historical DNA. *Journal of Wildlife Management* 71:2170-2179.

Here are my more specific comments:

1. The term “historic” is used incorrectly throughout the document; it should be changed to “historical” in all places. Historic means “unprecedented or particularly noteworthy”, whereas historical means “it happened in the past”.
2. You should include discussion of an important paper on fisher resting habitat selection in the southern Sierra Nevada that was recently published by Dr. Kathryn Purcell; e.g., in many places in the section beginning on p. 19:

Purcell, K.L., A.K. Mazzoni, S.R. Mori, and B.B. Boroski. 2009. Resting structures and resting habitat of fishers in the southern Sierra Nevada. *Forest Ecology and Management* 258:2696-2706.

3. In a number of places, you refer the reader to other citations in order to find the source you are actually citing: e.g., near the top of p. 5, you cite (Coulter and Powell *in* Douglas and Strickland 1999) and (Powell and Pittaway *in* Douglas and Strickland 1999); you don’t even provide the year of publication for the source you are actually citing! This is a very unhelpful and awkward format for the reader, and is not an appropriate way to cite scientific sources. You need to cite the original sources here, not simply send the reader to a review paper.
4. You need to be a bit more careful in your use of language in various places. E.g., in the middle of page 17, you state that “...and other unpublished trapping data and concluded that fishers may have recently expanded...” This is pure speculation, so “concluded” is not appropriate language to use here. I suggest you change this to “...and other unpublished trapping data and speculated that fishers may have recently expanded...”.
5. In the middle of p. 22, you state “It is clear that fishers need late-seral elements for rest and den sites, and that such elements...”. This statement is about resting and denning structures, not sites, so replace “rest and den sites” with “rest and den structures”.
6. You need to be very careful throughout the document to make a clear distinction between the importance of late-seral forests to fishers vs. the importance of late-seral forest characteristics, such as the individual structures they use for resting and denning that may occur in younger, closed-canopy forests. At the end of the second paragraph on p. 23, you talk about Klug not finding a “stand age-effect”, yet the topic of this paragraph is about late-seral forest elements, not late-seral forests per se. I.e., even though a stand may not be old in the average age of trees present, there may still be large old trees or snags present that can provide resting and denning habitat.

7. In the last paragraph before the “Snags” section on p. 24 you state that “...it is unclear how the areas identified as “occupied” were determined to be occupied, or in fact whether these plots...”. This is very unsatisfying; why can’t you contact Self et al. and get clarification on this?
8. In the first line of the 2<sup>nd</sup> paragraph in the “Snags” section on p. 24, you need to add “clearcut” before “timber practices”.
9. I found the last phrase about “dispersal on the edges of these populations” to be a non-sequitur – what does this have to do with the information presented in this section?
10. In the first paragraph at the top of p. 28, you talk about “effective population size” – I think this term needs to be defined in this kind of document; I suspect that many readers are unlikely to know exactly what this means...
11. In the first paragraph at the top of p. 30, you state, “Twenty-two percent (n=9) of monitored females denned in 2006...” It’s unclear to me exactly what the “n” represents – i.e., the total number of females, or the portion that denned? Assuming this means that 9 out of 41 females denned, it is much more informative to put (9/41) after the percent value, rather than requiring the reader to do a calculation in order to learn how many females there were...
12. In the first paragraph on Mortality and Survival on p. 30, you report annual female survival rates for the 2 northern study areas, but not the southern Sierra study area – what is the rate for that study area?
13. I’m not sure the “Density” section on p. 31 is in the right place. Wouldn’t this fit better in the previous section on Abundance?
14. Page 34, bottom of first paragraph. In my view, the NWFP and SNF are regional planning efforts, not landscape planning efforts.
15. Page 35, bottom paragraph. The third sentence is extremely long and difficult to understand. I suggest you break this down into at least 2 sentences and try to clarify exactly what you mean here.
16. Page 36, second paragraph. In the second-to-last sentence you talk about the need for a science-based quantitative assessment of the status of CA’s 2 fisher pops. That’s true for the northwestern population, but it’s not for the southern Sierra population - R5’s fisher monitoring program led by Rick Truex is exactly that!
17. Page 36. In the section entitled, “Potential reasons for the gap in fisher distribution in the Sierras”, you need to acknowledge that at least some portions of the current gap may have been present historically.
18. Page 37, 3<sup>rd</sup> paragraph. You state that “Greenwald et al. (2000) found that for his study

area...”. Greenwald et al. is a reference to the petition, not a fisher field study, so I have no idea what “study area” or whose “study area” you are referring to. Something’s wrong here...

19. Page 38, first line. Suggest you reword this, there is no such thing as “normal” ecological processes...
20. Page 40, first bullet. Suggest you reword as “The largest disturbance events affecting fishers...”.
21. Page 41, second paragraph. Both citations here for Aubry and Lewis need to be changed to (2003).
22. Page 44, middle of first paragraph. I think “Subsequently” is the wrong word here – did you mean “Consequently”??
23. Page 45, bottom of first paragraph. Have scientific names for bobcat and mountain lion been presented previously? Also, suggest you double-check that sci. names are given at the first mention of each species (e.g., the sci. name for bobcat is presented on p. 53...).
24. Page 46, second paragraph. Change “...same exact niche...” to “...same ecological niche...”. However, all of this discussion is highly speculative and somewhat questionable. First of all, neither wolverines nor SN red foxes are apex predators, and secondly, I think the extent to which their former ranges overlapped with historical fisher range was extremely limited. Basically, I didn’t find this paragraph to be at all compelling, and I’m not sure what it contributes to this status review...
25. Page 48, third bullet. I don’t know what “TPZ” refers to. Please define.
26. Page 52, bottom paragraph. I didn’t really follow this. If body-gripping traps were outlawed statewide in 1998, what difference does it make whether or not their use is restricted within the range of the Sierra Nevada red fox??
27. Page 56, second paragraph, last sentence. I suggest that you revise and clarify this sentence, which is somewhat of a non-sequitur – it doesn’t seem to follow well from the preceding discussion...
28. Page 64, bottom of first paragraph in Sensitive Species Designation section. I found the last 2 sentences to be problematic. Not only is this discussion highly speculative, but it doesn’t seem to follow well from the preceding sentences. This needs to be expanded and clarified, or deleted.



29. Page 76, last sentence of third paragraph in Translocation Update section. It seems to me that this is a serious problem. Given the uncertainty surrounding the historical occurrence of fishers in the translocation area, the lack of habitat with either moderate or high suitability based on empirically derived models should be a significant cause for concern...
30. Page 83, third paragraph. Keith Slauson and collaborators have recently demonstrated that a remnant populations of the Humboldt marten may occur along the CA and OR coasts, so I'm not sure it's appropriate to speak of the demise of this taxon...

Slauson, K.M., W.J. Zielinski, and K.D. Stone. 2009. Characterizing the molecular variation among American marten (*Martes americana*) subspecies from Oregon and California. *Conservation Genetics* 10:1337-1341.

31. Page 85, bottom of first paragraph. You refer here to the "genetic similarities" of the 2 extant populations in CA, but this statement contradicts Mike Schwartz's findings that these 2 pops are so different genetically that they must have been isolated from each other for many thousands of years... Thus, I do not think it is appropriate to state that "The 2 populations must be considered connected in terms of population rescue...". These populations are not connected, and it appears they have not been connected during most of the last 10,000 years.

I sincerely hope that my comments and suggestions are helpful.

Best regards,

Keith B. Aubry

Keith B. Aubry, Ph.D.  
Research Wildlife Biologist



COLLEGE OF NATURAL RESOURCES  
DEPARTMENT OF ENVIRONMENTAL SCIENCE, POLICY & MANAGEMENT  
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FAX (510) 643-5438

January 29, 2010

Esther Burkett  
Nongame Wildlife Program  
1812 Ninth Street  
Sacramento, CA 95814

Dear Esther:

Herewith is my review of the January 23, 2010, draft "Status Review of Fisher In California: Report to the Fish and Game Commission" (Review) as requested. I have carefully read the entire document. I am returning the manuscript to you with this letter. I have noted a number of grammatical and other minor comments in the margins and will not detail these suggestions in this letter.

Overall, I find the Review detailed and thorough. I did not detect any errors of fact or interpretation of existing research. I would argue that the information now available supports a recommendation to list at least the southern Sierra population as "threatened." It is generally recognized by conservation biologists that when a population falls below about 5,000 (as is the case for the southern Sierra population, which is certainly below 500 fisher total), it is time to get serious about making substantial efforts to increase it, typically by improving habitat, or by connecting it to a neighboring population. Both these approaches are warranted in this case given our understanding of the biology of the situation. Not doing so would indicate a politically motivated decision rather than one based only on biology.

I can add one piece of new information available since the Review was drafted resulting from the contract you provided me to run camera traps in the Yosemite area. Thirty camera traps have been deployed for a month between the Mariposa Grove and Yosemite Valley. Six trap sites have produced photos of fisher as of yesterday, all of them well south of the Merced River. No detections have been made so far in the Yosemite Valley. Although these results are preliminary, they support the hypothesis that there is a problem in fisher dispersing northward across the Merced River. This is counter to the prediction of the Spencer et al. (2008) report, which argued that the southern Sierra population is likely to be in the process of expanding northward across the Merced River. They did not consider the mortality factors of road-kill, disease or predation, all of which are turning out to be important causes of mortality in the SNAMP study just to the south. As you know, one of my stated hypotheses of the SNAMP study is that the southern Sierra population is continuing to retract southward as it apparently has since the 1940's. To date, I am not aware of any data to discount this hypothesis.

The Truex et al. (2009) surveys have documented that the Sequoia population is likely a “source” (produces significant dispersing young) population, and that the entire population has remained relatively stable. However, this monitoring effort, while necessary, is not sufficient to detect small scale range shifts at the northern edge of the range in the vicinity of the Merced River. We do not yet have enough information to confirm whether the southern Sierra population is expanding or contracting at its northern edge; what little information we have suggests the latter. I would emphasize the importance of the distinction between source versus sink habitat.

If the fisher population were growing and expanding northward from the Sequoia one would expect the genetic makeup of the northern animals to be similar to those in the south, but this is not the case. The highly structured pattern detected to date suggests contraction rather than expansion of the population. I would emphasize the potential genetic problems of such a structured population with overall very low heterozygosity.

I will comment that the reintroduction effort the Department is undertaking in the northern Sierra is exactly what I have been suggesting to all concerned for many years. I hope it will prove successful. However, we will not know if this is the case for several years, and only if intensive monitoring is maintained to determine what the limiting factors may be if it is not successful. In any case, this reintroduction is too distant from the southern Sierra population to be of help in reconnecting it to the northern California population for many years. If it is successful, additional reintroductions should be made throughout the northern and central Sierra.

I will also comment that I would emphasize more strongly the nature of habitat fragmentation in the southern Sierra. The fact that the mixed conifer zone is rarely wider than the home range of a single male fisher predisposes this population to all the implications of small, fragmented populations even before you add the effects of forest practices and other human disturbances. All the camera trapping at a 1km scale in the Sierra National Forest has shown the highly fragmented nature of this population. It is like a string of beads, or lacework pattern rather than large solid blocks of “source” habitat. The current highly fragmented pattern is also evident in the habitat suitability map produced by the Spencer et al. (2008) report. My camera trapping work supports the validity of this map. I would add here that rather than canopy cover, the Spencer model uses total forest biomass. This seems to be a very useful measure of fisher habitat quality. I note that giant sequoia groves (very high biomass) appear to provide particularly good fisher habitat.

I will also comment that it appears the porcupine and the snowshoe hare are absent from the southern Sierra. These are the preferred food of the fisher, which must make do with squirrels, particularly the western gray squirrel as it’s preferred food now. Gray squirrels are primarily dependent on black oak acorn crops, which are quite variable. Therefore one can expect squirrels and fisher populations will vary substantially with mast crops. Such variability will exacerbate problems of small populations. I have long suggested the Department reintroduce porcupines to the southern Sierra to provide a better and more stable food source for fisher.

Finally, I will comment that we do not know the pattern of dispersal for young fisher in the narrow band of habitat in the southern Sierra. Do they disperse in all directions, or do

they only disperse north and south in suitable habitat? If the former (which is typical of most animals), then half or more of any dispersing fisher produced in a source habitat may travel into “ecological traps” of unsuitable habitat in the San Joaquin valley or across the Sierra Crest into the Great Basin. This would considerably reduce the ability of this population to expand. We do not yet know to what extent this is a problem.

I trust these comments may be of use to you and the Department of Fish and Game. Please let me know if I can be of any further assistance or clarify any of my comments.

Sincerely,

A handwritten signature in black ink, reading "Reginald H. Barrett". The signature is written in a cursive style with a large initial 'R' and a long horizontal stroke at the end.

Reginald H. Barrett  
Goertz Professor of Wildlife Management



# HUMBOLDT STATE UNIVERSITY

Department of Wildlife

3 February 2010

California Department of Fish and Game

Attn: Esther Burkett

<sup>th</sup>  
1812 9<sup>th</sup> Street  
Sacramento, California 95811

Dear Ms Burkett:

Thank you for the opportunity to review the draft version of the "Status Review of Fisher in California" dated January 23, 2010. As a matter of background, I and my students (C. Fowler, A. Seglund, S. Dark, J. Dayton, K. Sager, K. Beyer, T. Penland, J. Thompson, R. Klug, S. Yaeger) or staff have been conducting research on Fisher in many areas of California since the late 80's. These investigations have included the early development of techniques (smoke plates, cameras, traps, and monitoring techniques), rest sites, food habits, home ranges, and habitat assessment. Our study areas have included the north coastal forests, managed timberlands in the Klamath Province, the Hoopa Reservation, and Forest Service lands in the Shasta-Trinity area, as well as in the Tahoe and the Kings Canyon areas. It is with this background that I offer my comments.

The document appears to be accurate and well documented. The literature appears to be quite complete and makes the distinctions when necessary between peer-reviewed data and opinions or non-reviewed studies. I have divided my comments below into simple editorial issues and general comments about content.

On page 15, a contributor to the idea of cooperative management is that individual fisher also use very large pieces of real estate (eg: one individual may encompass several ownerships).

Caution is necessary in extrapolating findings at Hoopa to elsewhere in the fisher range (pg 32). In the recent decades fisher have appeared to do relatively well at this site, and investigators are learning much about fisher in these forests. But this site has extensive hardwoods and productivity that does not characterize other forests to the east (see Yaeger 2005) or to the west nearer the coast. Hardwoods have been noted by several authors to be used as den sites. They may also produce mast that in turn feeds a number of fisher prey. I was concerned that the uniqueness of the Hoopa forests may not be immediately apparent to a reader who is not familiar with the area.

On page 46, I was left with the impression that past removal of predators may be negatively impacting fisher through the mechanism of "meso-predator release". Although I agree that we have little knowledge of how old intact forests functioned, I doubt that meso-predator release would have depressed the number of fisher. This would have required removal of a

top predator that depressed a predator that in turn fed on fisher. Other than Grizzly Bears, it is hard to imagine a predator in California that historically suppressed either coyotes or mountain lions. Red fox would be unlikely to suppress either bobcat or fisher (more likely the bobcat or fisher would kill the red fox). In the absence of coyotes, bobcat, or mountain lion, fisher might actually increase. My recommendation is to reduce this section to simply indicate that the relationship with other wide ranging predators is unknown, and that naturally occurring coyotes, lions, and bobcat probably prey on fisher.

On page 81, your recommendation about dogs may need strengthening. As interest in fisher issues has grown in recent years, so to have the number of researchers. Many researchers come in close contact with the study animals. Many of us also have dogs (myself included). As a precaution, it might be wise to indicate that the research community should also keep their dogs away from fisher and the equipment used in fisher research (a dog in the back of a truck that is shared by empty fisher traps should be avoided). Based on first-hand experience with our crews, this indirect association is not always recognized.

To accurately understand habitat used by fisher, it is important to convey to the reader the distinctions between regions in the distribution of fisher. This is more than the typically described southern Sierra Nevada and northwestern California. The near-coast region is different than the east side of the Trinity mountains because the forests are different in both the vegetative species and the time to recover from disturbance such as timber harvest. The manuscript clearly indicated differences in harvest practices, but I think it useful to note that vegetative responses are also different. Re-growing coastal redwoods will provide closed canopies much faster than the forests to the east of the Trinity mountains, and the general Klamath area recovers faster than harsh sites on the west face of the Sierras. Thus the time to be considered in the cumulative impact is greater for the slower growing forests. This time period may be crucial to the issues of fisher food and cover requirements and the time period that lands are unusable to fisher. Judgments for fisher management must be made based on differing regional impacts and should not be expected to be similar at all sites.

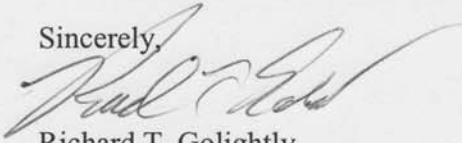
The manuscript that I reviewed did not identify the specific logic used to support or exclude the potential of providing threatened or endangered status for this species in California. My expertise includes the biology that might be used to support such a decision, but my background does not specifically include the "policy" experience to formulate that decision. Once a policy or regulation has been proposed, I would be willing to indicate whether or not I thought that the biological arguments for that policy were supported by this document. However, as policy is considered, I would urge the Department to consider the range of land practices and habitat differences (both spatial and temporal) described in the previous paragraph. The small size of the southern Sierra population makes this population extremely vulnerable. Further the lack of consistent recent sightings in the central Sierra should be a source of concern.

Editorial notes:

1. Boroski et al. (2002) was missing in the lit cited.
2. Page 21, reference to "Table 7" was confusing.
3. Page 24, line 3 was awkward.
4. Page 33, note a typo in line 6.

5. No where in the document did I find reference to the change in ownership of Pacific Lumber, yet tense would suggest the company still exists. I would recommend that the new owner of the HCP and lands be identified at first use.

Sincerely,

A handwritten signature in cursive script, appearing to read "Richard T. Golightly".

Richard T. Golightly  
Professor

**From:** Malcolm North <mnorth@ucdavis.edu>  
**To:** Esther Burkett <EBurkett@dfg.ca.gov>  
**Date:** 1/28/2010 9:29 PM  
**Subject:** Re: Fisher Status Review, Peer Review

Esther,

Thank you for the opportunity to review the Status Review of Fisher in California. It's well written and contains an impressive synthesis of a broad range of literature and research findings. In contrast, the Center for Biological Diversity petition also references a lot of the literature but for the areas I can best speak to, the forest logging and fire sections, the information has often been misconstrued. The descriptions of logging practices are not far off up to about the 1980s but since then practices do not resemble what CBD presents. Their summary of the Kings River Administrative Study is inaccurate, as is their contention that late-seral forest associated with fisher has a reduced risk of high-severity fire. I would not discount some of their contentions, and certainly there are inferential reasons to suggest logging has contributed to fisher declines, but they stretch beyond what can be supported.

In the Status Review I've paid particular attention to page 33-41, as you suggested, the sections on forest and disturbance. The section is accurate and covers the topic briefly but accurately. My main suggestion has to do with adding some emphasis on the effects of fire suppression not only on the fire regime but also on habitat conditions and ecosystem processes.

My main comment builds upon informed speculation about a subject I've raised with Bill Zielinski that both of us find interesting but without a means of resolving it. The gap in the fisher's distribution does indeed coincide with the area of the Sierra Nevada which has been most heavily logged and which has fewer old forest structures. It is, however, also the area that has been most severely impacted by fire suppression that has dramatically reduced forest and habitat heterogeneity. The southern edge of the gap in the fisher distribution is also right where forest conditions change from xeric to more mesic (for example it's the southern extent of Douglas fir, which in the Cascades and Sierra is a species associated with mesic conditions). With this increased precipitation, fire suppressed forests from Yosemite north support much higher infilling of shade-tolerant, fire-sensitive firs and cedar. From about the Merced River north, the forest is much more homogenous with little variety in microclimate, canopy cover, and microhabitat. I would note that the fisher distribution stops just south of the Merced River, yet there are substantial areas of low elevation, old forest conditions within Yosemite Park for another 100 km north of the Merced. For a predator with such a variety of prey I can't help but wonder that foraging conditions and prey diversity have been greatly reduced. I certainly agree with Bill that resting and denning structures are very important, but we have little information on foraging behavior and I can't entirely discount that changes in foraging opportunities, which are going to make up 90% of a fisher's home range, might also be limiting the population.

You briefly mention near the top of p. 38 that fire is a major force in these ecosystems, but I'd suggest there's enough literature to say more. It's really the keystone process in forests occupied by fisher. Many ecosystem processes stall without it, and the resulting high stem densities, canopy cover and thick surface litter and fuels have cascading effects on core



ecological functions like decomposition, nutrient cycling, respiration, and soil moisture use. Your discussion rightly focuses on how fire-suppressed changes in forest conditions change the fire regime to infrequent, high-intensity fire that can eliminate fisher habitat. I'd also suggest it has a pervasive and substantial alteration of ecosystem conditions, many of which we are woefully ignorant of. Since fisher evolved in forests with frequent fire, there are likely substantial impacts on them from this fundamental change in forest conditions. I think people sometimes believe that while fire suppression may increase fire severity it may have also unintentionally benefited the fisher and spotted owl by increasing the high canopy cover and stem density conditions they're associated with for resting and nesting. For both critters there's more to their habitat requirements than just providing these structures. Even in the most severely cut over areas in the Sierra, there are still remnant pockets of old forest structure. What we know about the importance of fire, however, would suggest it's probably had a significant altering effect on habitat quality. I don't discount the deleterious effects of logging, but probably the most endangered thing in the Sierra is frequent, low-intensity fire. Its absence has certainly also had a profound effect on the fisher.

That's my main suggestion. I hope this is of some help.

Malcolm North  
USFS Pacific Southwest Research Station  
Sierra Nevada Research Center  
1731 Research Park Dr.  
Davis, CA 95618  
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530-754-7398  
Lab: <http://www.plantsciences.ucdavis.edu/affiliates/north/index.html>

On 1/24/10 7:21 PM, "Esther Burkett" <EBurkett@dfg.ca.gov> wrote:

> Hi Malcolm,  
>  
> I'm not sure if you found out if you are heading overseas for the research  
> opportunity you mentioned, but, even if you are, I'm hoping you can at least  
> take a look at the Catastrophic Fire section of the subject report, and the  
> Figures.  
>  
> I have a bound hard copy ready for you, and I can have it hand-delivered  
> tomorrow if you can send me your whereabouts on campus; we can leave it in  
> safe place where you direct us if you are busy running about.  
>  
> I'll also send electronic version tomorrow, in case you want to query for key  
> words.  
>  
> Thank you again for considering this request.  
>  
> Sincerely,  
> Esther  
>  
> Esther Burkett

## **Appendix C**

### Public Comments

## **Summary of Comments Received:**

Sixteen respondents commented during the public notice periods. A summary of the comments is provided below. Copies of the comments may be obtained by contacting the Department of Fish and Game (Esther Burkett, [eburkett@dfg.ca.gov](mailto:eburkett@dfg.ca.gov)).

- Thirty-eight percent (38%) opposed listing of the fisher.
- Thirty-eight percent (38%) supported listing of the fisher.
- Twenty-five percent (25%) did not state support or opposition.

Thirty-eight percent (38%) of the responses came from timber companies, forestry or other industry representation; 25% of the responses were from non-profit or non-governmental organizations; 25% of the responses came from fisher researchers; and 13% of the responses came from members of the public.

## **List of Comments Received:**

### **Thomas E. Kucera, Ph.D.**

Letter from Thomas E. Kucera, Ph.D., dated August 4, 2008 (7 pages) to the Fish and Game Commission. Identified threats such as habitat loss due to timber harvest, elucidated habitat requirements such as rest sites and high canopy cover, and discussed inadequacy of existing regulations. Supported listing of the fisher.

### **Mark Jordan, Ph.D.**

Letter from Mark Jordan, Ph.D., dated February 27, 2009 (3 pages) to the Fish and Game Commission. Supported reconsidering the petition, and had concerns about how the baseline population estimate for fisher was determined and how fisher habitat was characterized in the Department's petition evaluation report. Dr. Jordan did not provide a statement of support or rejection of listing during the public comment period for the status review.

### **Michael K. Schwartz, Ph.D.**

Letter from Michael K. Schwartz, Ph.D., dated August 21, 2009 (2 pages), to Ms. Esther Burkett, discussing his collaborative study on the phylogenetic

relationship between fishers in the northern and southern portion of their range in California. No statement of support or rejection of listing the fisher was provided.

### **Jody Tucker**

Letter from Jody Tucker, dated August 21, 2009 (2 pages), to Ms. Esther Burkett, discussing their preliminary results from ongoing genetic research in the southern Sierra Nevada. No statement of support or rejection of listing the fisher was provided.

### **Timber Products Company**

Letter from Stuart Farber, dated August 14, 2009 (2 pages), to Ms. Esther Burkett, California Department of Fish and Game (Department), providing updates to a genetic study conducted by Timber Products Company, with an enclosed presentation entitled: Cooperative Mesocarnivore Genetic Surveys to Estimate the Number of Individuals and Preliminary Population Structure in Northern Siskiyou County, California; Stuart Farber, Rich Callas, Steve Burton, Laura Finley, Scott Yaeger, Michael Schwartz (11 slides). The presentation discussed genetic origins of the fishers, demographics, and population structure. Other studies itemized in the letter were also described in the March 19, 2008 letter from Stuart Farber, contained in Appendix C of the Department's Evaluation of Petition: Request of the Center for Biological Diversity to List the Pacific Fisher (*Martes pennanti*) as Threatened or Endangered, dated June 2008 (petition evaluation report). No statement of support or rejection of listing was provided. However, during the petition evaluation comment period, Timber Products Company rejected listing of the fisher. Stuart Farber was co-author of a document entitled "Management Considerations and Habitat Protection Provided for Pacific Fishers on Private Forestlands in California" dated April 25, 2008 which did not support listing of the fisher.

### **Roseburg**

Letter from Richard R. Klug, Jr., dated August 14, 2009 (2 pages), to Ms. Esther Burkett, updating information regarding Habitat Retention Areas from previously submitted material, as well as documenting additional fisher occurrences on their ownership. The letter includes a map of survey and scat collection sites within the Roaring Creek watershed between the Pit River and State Route 299 for a survey conducted in fall 2008. No statement of support or rejection of listing was provided. However, during the petition evaluation comment period, Roseburg Resources Company rejected listing of the fisher. Richard Klug was co-author of a document entitled "Management Considerations and Habitat Protection

Provided for Pacific Fishers on Private Forestlands in California” dated April 25, 2008 which did not support listing of the fisher.

### **California Forestry Association (CFA)**

Letter from Michele Dias, dated August 20, 2009 (1 page), to Ms. Esther Burkett, re-submitting comments, described in Appendix C of the Department’s petition evaluation report, as Attachment A. Attachment B contained a report from the Hoopa Valley Reservation regarding ongoing research and conservation efforts (Higley, J.M. and S. Matthews, 2009, Fisher habitat use and population monitoring on the Hoopa Valley Reservation, California, Final Report USFWS TWG U-12-NA-1, 82 pages plus title page, contents, and acknowledgements). The report is attached to support CFA’s suggestion that the fisher population within the managed study area is stable and increasing. CFA does not support listing of the fisher.

### **Defenders of Wildlife**

Letter from Pamela Flick, dated August 21, 2009 (4 pages), to Ms. Esther Burkett, in support of listing the fisher as threatened or endangered under CESA, with 5 enclosures:

- Presentation dated July 15, 2009, for the Sierra Nevada Adaptive Management Project (SNAMP) Fisher Integration Meeting in Fresno, California, presented by Rick A. Sweitzer and Reginald H. Barrett, entitled: SNAMP Fisher Study: Description and Current Status (17 pages, 35 slides). The presentation discussed fisher populations retracting southward, population parameters and limiting factors, and effects of fuel reduction treatments on the fisher.
- Presentation dated July 15, 2009, for the SNAMP Fisher Integration Meeting in Fresno, California, presented by Rick A. Sweitzer and Reginald H. Barrett, entitled: SNAMP Fisher Study: Sources of Mortality (9 pages, 19 slides). The presentation discussed fisher mortality and disease, addressing numbers, causes, and distribution of mortalities within a study area.
- U.S. Fish and Wildlife Service Federal Register dated April 8, 2004 (45 pages), containing 50 CFR Part 17, Endangered and Threatened Wildlife and Plants; 12-month Finding for a Petition to List the West Coast Distinct Population Segment of the Fisher (*Martes pennanti*); Proposed Rule.
- Petition to list the fisher (*Martes pennanti*) as an endangered species in its West Coast range, dated November 2000, prepared by the Center for

Biological Diversity and the Sierra Nevada Forest Protection Campaign (91 pages plus executive summary and appendix). Seventeen additional petitioners are listed on the title page. This enclosure additionally includes: a cover letter dated November 28, 2000 to Mr. Bruce Babbitt, Department of the Interior (3 pages).

- Status review of the southern Sierra Nevada population of the fisher (*Martes pennanti*), undated, prepared by the Center for Biological Diversity and the Sierra Nevada Forest Protection Campaign (32 pages plus appendix). Supporters listed on the title page include Natural Resources Defense Council, Center for Sierra Nevada Conservation, Wilderness Society, and the Sierra Club.

### **Green Diamond Resource Company**

Letter from Neal Ewald, dated August 21, 2009 (3 pages), to Ms. Esther Burkett, referencing scientific information, Lowell Diller's May 7, 2008 presentation at the stakeholder meeting, and correspondence previously submitted to the Department (see Appendix C of the Department's petition evaluation report). The correspondence included three attachments which are itemized below. Green Diamond does not support listing of the fisher.

- Summary of Fisher (*Martes pennanti*) Studies on Green Diamond Resource Company Timberlands, North Coastal California, dated August 13, 2009 (54 pages), compiled by Lowell Diller, Keith Hamm, David Lamphear (Green Diamond), and Joel Thompson (Western EcoSystems Technology, Inc.).
- Terrestrial Dead Wood Management Plan for Green Diamond Resource Company, dated April 13, 2005 (15 pages).
- Photos taken on Green Diamond timberland showing examples of habitat and associated forest structure used by fishers (8 figures, 8 pages).

### **Center for Biological Diversity**

Letter from Justin Augustine, dated August 21, 2009 (19 pages), to Ms. Esther Burkett, describing CESA and issues the Department should address during its status review of the fisher, with a detailed description of literature pertaining to fisher habitat. The letter also recommended steps the Department should take to ensure a thorough status review. Center for Biological Diversity authored the petition to list the fisher.

## **Sierra Pacific Industries (SPI)**

Letter from Edward C. Murphy, dated August 21, 2009 (1 page), to Ms. Esther Burkett, itemizing six documents that had previously been sent to Eric Loft; three documents associated with the Candidate Conservation Agreement with Assurances (CCAA) between the U.S. Fish and Wildlife Service (Service) and SPI for fishers in their Stirling Management Unit; and a pictorial of the types of structures and wildlife habitat retention areas left after SPI harvests. SPI does not support listing of the fisher. The itemized documents were attached or subsequently sent as follows:

- A progress report to the Department of Fish and Game on SPI's fisher reproduction study, described in Appendix C of the Department's petition evaluation report.
- A letter discussing the petition's statements regarding SPI's draft CCAA for the fisher in California, described in Appendix C of the Department's petition evaluation report.
- A white paper discussing the historic, current and future threats facing the fisher and its habitat in California, described in Appendix C of the Department's petition evaluation report.
- A white paper discussing the existing regulatory mechanisms on all ownerships, public and private, within the range of the fisher in California, described in Appendix C of the Department's petition evaluation report.
- A white paper predicting the number of fishers in California's two populations using the best scientific data and methods available, described in Appendix C of the Department's petition evaluation report.
- A white paper presenting data on overhead canopy cover re-growth after forest harvesting on private lands in California as it relates to fisher foraging and travel habitat, described in Appendix C of the Department's petition evaluation report.
- CCAA between the Service and SPI for the Stirling Management Unit, signed and dated May 18, 2008, 32 pages.
- A federal document associated with the CCAA entitled: Conference Opinion and Findings and Recommendations on Issuance of an Enhancement of Survival Permit for the Fisher to Sierra Pacific Industries, Inc., 21 pages.
- A federal document associated with the CCAA entitled: Final Environmental Action Screening Form for Candidate Conservation

Agreement with Assurances (CCAA), signed and dated May 15, 2008, 15 pages.

- A compilation of 26 photographs in a document entitled: Landscape Structures and Wildlife Retention Islands: A Pictorial, 14 pages. These photographs were sent to demonstrate the types of structures and landscape retention islands that are left after a harvest to provide habitat for the fisher.

### **Fruit Growers Supply Company**

Email from Daniel J. Fisher to [fishercomments@dfg.ca.gov](mailto:fishercomments@dfg.ca.gov), dated September 9, 2009, commenting on the suitability of the National Forest habitats for fisher. Mr. Fisher stated that populations are growing and does not support the petition to list the fisher.

### **Nana Corfield (unaffiliated)**

Email from Nana Corfield to the Department of Fish and Game, dated September 13, 2009, supporting the listing of fisher as an endangered or threatened species, with comments on loss of habitat and the permanence of extinction.

### **WildRescue**

Email from Rebecca Dmytryk to [fishercomments@dfg.ca.gov](mailto:fishercomments@dfg.ca.gov), dated September 15, 2009, supporting the listing of fisher as an endangered or threatened species.

### **On Shore Foundation, Inc.**

Email from Elizabeth Luster to the Department of Fish and Game, dated September 15, 2009, supporting the listing of fisher as an endangered or threatened species.

### **Nancy Sauers (unaffiliated)**

Email from Nancy Sauers to [fishercomments@dfg.ca.gov](mailto:fishercomments@dfg.ca.gov), dated December 17, 2009, reporting possible sightings of fishers in Nevada County. No statement of support or rejection of listing the fisher was provided.



## Appendix D

Fisher Distribution Maps from Sierra Pacific Industries' Candidate Conservation Agreement with Assurances and associated Conference Opinion issued by U.S. Fish and Wildlife Service (signed May 15, 2008)

1. **Figure 1.** Historical and contemporary fisher locations in northwestern California, page 17 of "Conference Opinion and Findings and Recommendations on Issuance of an Enhancement of Survival Permit for the Fisher (*Martes pennanti*) to Sierra Pacific Industries, Inc."

Permit Number TE166855-0

Note the corrected figure reference to Grinnell et al. (1937) map is Figure 75. Literature cited in the map legend is also attached.

2. **Figure 2.** Opinion-based distribution of fisher in California and southwestern Oregon, page 4 of Candidate Conservation Agreement with Assurances for Fisher for the Stirling Management Area, between Sierra Pacific Industries and U.S. Fish and Wildlife Service.

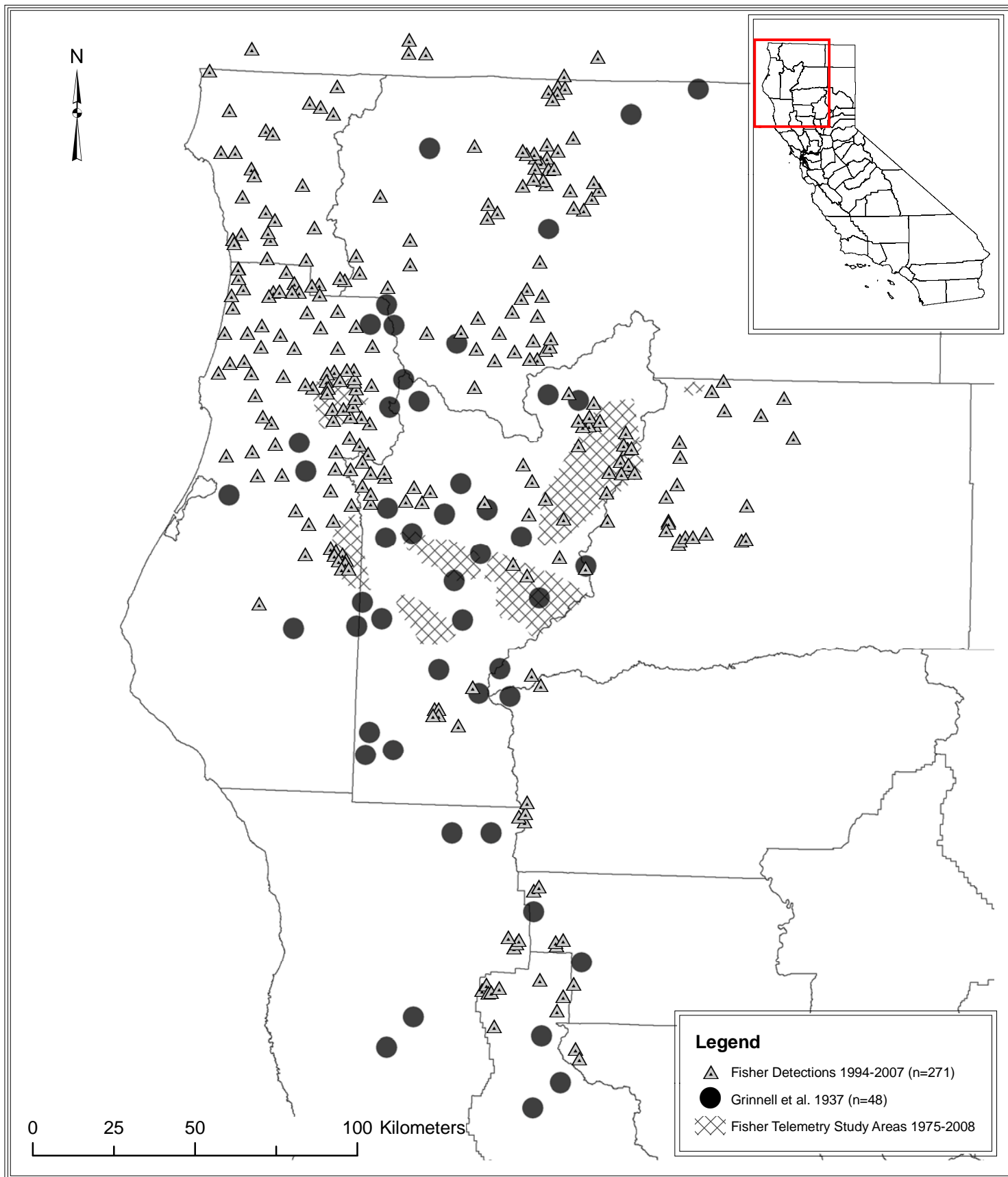


Figure 1. Historical and contemporary fisher locations in northwestern California. Historical locations adapted from Grinnell et al. 1937 figure 75. Contemporary locations (triangles) from miscellaneous surveys (Beyer and Golightly 1996, Dark 1997, Carroll et al. 1999, Zielinski et al. 2000, Slauson and Zielinski 2001, Slauson et al. 2001, Hamm et al. 2003, Slauson et al. 2003, Slauson and Zielinski 2004, Lindstrand 2006, Slauson and Zielinski 2007, Farber et al. 2008, USFWS unpublished data). Cross-hatching represents fisher telemetry study areas (Buck et al. 1994, Self and Kerns 2001, Zielinski et al. 2004, Yaeger 2005). Points represent presence only and do not imply abundance or density.

## References for Figure 1 Conference Opinion Map

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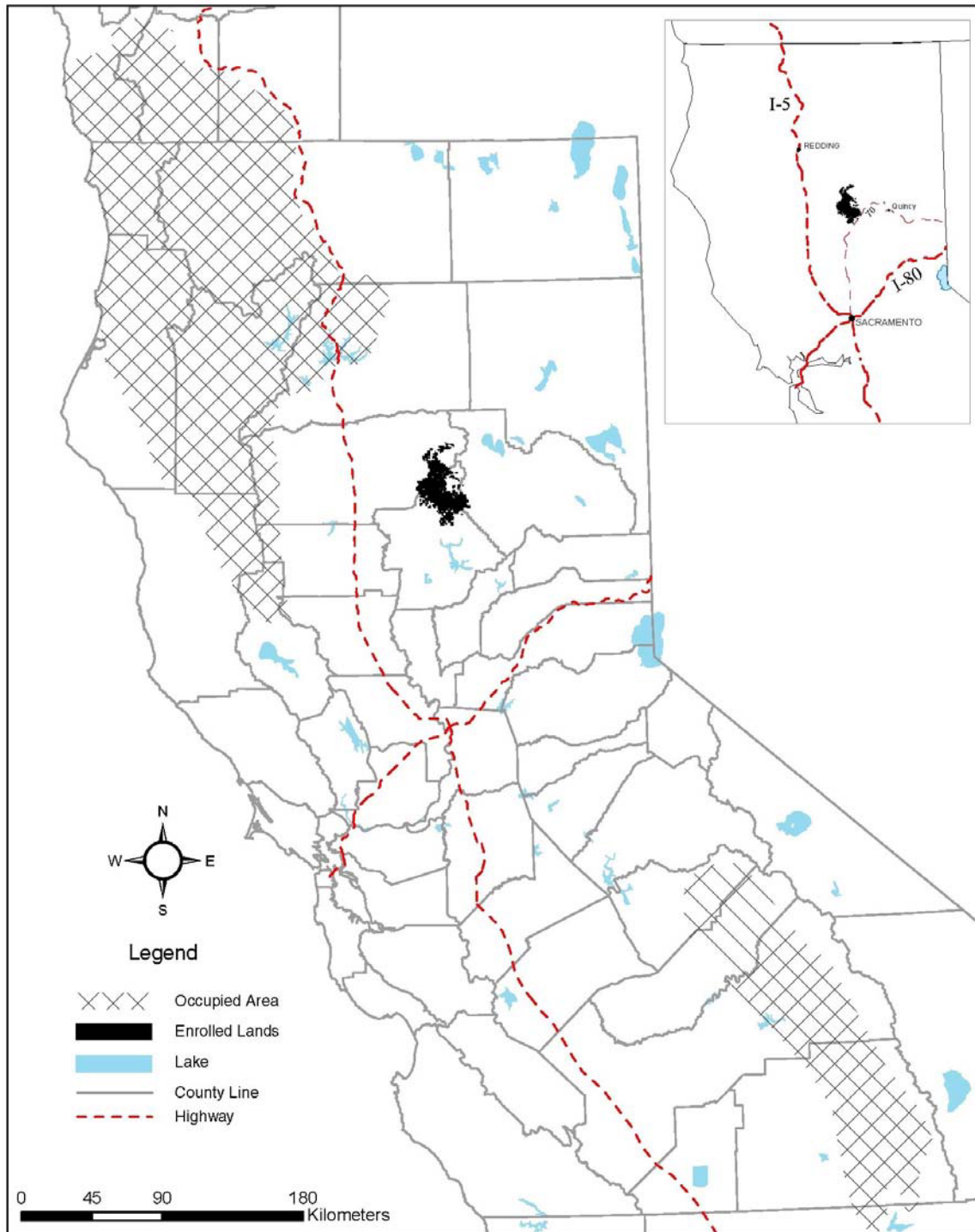


Figure 2. Opinion based distribution of fisher in California and southwestern Oregon. Distribution representations based on current understanding of extent of occurrence for fisher from contemporary survey and research data (USFWS 2008). Enrolled lands shown for reference.

## Appendix E

### Home range and den and rest site characteristics

#### *Home range*

1. Average home range estimates for adult male and female fishers in the eastern Klamath, north coast, and southern Sierra from 1992-1996, Figure 7 from Truex et al. (1998).

#### *Den sites*

1. Habitat characteristics around female fisher den sites, Table 4 from Truex et al. (1998). Note that some of this information is repeated in the Table included below, and cited as Truex et al. (1998).
2. Habitat values associated with den locations of female radio-marked fishers in California, southern Oregon, and British Columbia, Table 2 (page 10 [11]) from Candidate Conservation Agreement with Assurances for Fisher for the Stirling Management Area, between Sierra Pacific Industries and U.S. Fish and Wildlife Service.
3. Den site characteristics of female fisher on Hoopa Tribal lands during 2005-2007, Table 13 from Matthews et al. (2008).
4. Den site characteristics of female fisher on Sierra Pacific Industries lands during 2006-2007 (Sacramento Canyon and Hayfork summit study areas), Tables 6 and 7 from Reno et al. (2008).

### *Rest sites*

1. Habitat characteristics of fisher rest sites from 3 study areas in California, Tables 6 and 7 from Truex et al. (1998). Note that some of this information is repeated in the Table included below, and cited as Zielinski et al. (2004a).
2. Habitat values associated with rest locations of radio-marked fishers in California and southern Oregon, Table 1 (page 9 [10]) from Candidate Conservation Agreement with Assurances for Fisher for the Stirling Management Area, between Sierra Pacific Industries and U.S. Fish and Wildlife Service.



Figure 7. Average Minimum Convex Polygon home range estimates in ha (error bars = 1 SD) for adult fishers monitored a minimum of 9 months and located at rest sites at least 10 times for the Eastern Klamath ( $n = 6$  male, 5 female), North Coast ( $n = 2$  male, 5 female), and southern Sierra ( $n = 4$  male, 7 female) study areas, 1992-1996.



Table 4. Descriptions of natal and maternal dens and the surrounding habitat for female fishers in the Eastern Klamath, North Coast, and Southern Sierra regions of California. Natal dens refer to the site where parturition is assumed to have occurred while maternal dens refer to sites where an adult female was observed resting with one or more kit(s).

Study Area	Indiv.	Den Type	Tree Species	Tree Cond.	DBH (cm)	BA	Canopy Closure
Eastern Klamath	1	Maternal	PIPO	snag	78	59.4	70
	2	Maternal	QUKE	live	88	18.3	98
	3	Maternal	QUCH	live	52	59.4	75
	3	Maternal	QUCH	live	40	27.4	77
	3	Maternal	PSME	live			
North Coast	1	Maternal	CADE	live	105	101.6	97
	2	Maternal	PSME	live	138	78.5	98
	2	Maternal	QUKE	live	53	73.9	100
	3	Maternal	ABCO	log		120.0	72
	3	Maternal	PSME	live	99	50.8	99
	4	Maternal	ABCO	snag	125	166.3	96
Southern Sierra	1	Natal	ABCO	snag	148	32.1	94
	1	Natal	UNK	snag	112	64.3	96
	2	Natal	ABCO	live	82	64.3	96
	3	Natal	QUKE	live	99	59.7	93
	3	Natal	QUKE	live	76	114.8	97
	3	Maternal	QUKE	live	40	23.1	89
	3	Maternal	ABCO	live	146	27.7	93
	4	Maternal	QUKE	live	52	60.1	96

Table 2. Values associated with reproductive den (natal and maternal combined) locations of radio-collared fisher at various study areas in California, southern Oregon, and British Columbia

Study Area	Source	n Indiv Fisher	Den Tree Type	n Structure	Average dbh of Den Tree (in)	StDev of Den Structure (in)	Average QMD <sup>a</sup> of Den Site (in)	StDev of Den Site QMD (in)
British Columbia	Weir 2003		Hardwood	19	41.5			
British Columbia	Weir 2007	4	Hardwood	9	19.8	3.5		
Southern Oregon Cascades (natal dens)	Aubry and Raley 2006	6	Live tree	7	36.2			
			Snag	6	35.0			
Southern Oregon Cascades (maternal dens)	Aubry and Raley 2006	6	Live tree	8	38.2			
			Snag	5	51.9			
			Log	5	41.3			
North Coast (Six Rivers)	Truex et al. 1998	4	Hardwood	1	20.9			
			Conifer	4	46.0			
Coastal Klamath Province (Hoopa)	Yaeger 2005	5	Hardwood snag	1	24		13.0	5.1
			Hardwood	8	25.1	5.6		
			Conifer snag	1	37.9			
Coastal Klamath Province (Hoopa)	Higley and Matthews 2006	16	Live tree	37	40.9			
			Snags	10				
Interior Klamath Province (Trinity Lake)	Yaeger 2005		Hardwood	5	28.2	13.8		
			Conifer snag	1	30.7			
Interior Klamath Province (Weaverville)	Self 2008	9	Hardwood	37	24.8	11.6	10.7	1.5
			Conifer	5	43.4	20.7		
			Snag	20	33.7	14.3		
Southern Sierra Nevada	Truex et al. 1998	4	Hardwood	4	26.3			
			Conifer	3	49.3			

<sup>a</sup> - QMD calculations do not include den structure.

dbh-Diameter Breast High (4.5ft above ground)

StDev-Standard Deviation

in-inches

QMD-Quadratic Mean Diameter

From page 10 [11] of Candidate Conservation Agreement with Assurances for Fisher for the Stirling Management Area, between Sierra Pacific Industries and U.S. Fish and Wildlife Service, signed May 15, 2008, 33 pages.

Table 13. The tree species, condition (snag or live tree), mean dbh, and dbh range of natal, maternal-pre-weaning, and maternal-post-weaning den trees used by fisher on the Hoopa Valley Reservation, CA during the 2005, 2006, and 2007 den seasons.

<b>Natal n=26</b>				
Tree Species	Snag	Live Tree	Mean DBH (cm)	DBH Range (cm)
Douglas Fir	3	2	135	104 - 192
Black Oak		4	83	47.5 - 149
Tan Oak		15	89	43 - 106.7
Chinquapin		2	46	36.6 - 55.6
<b>Maternal-Pre-Weaning n=43</b>				
Tree Species	Snag	Live Tree	Mean DBH	DBH Range
Douglas Fir	5	5	130	76.2 - 205
Port-Orford Cedar		1	137	
Sugar Pine	2		80	57.4 - 101.6
Black Oak	2	7	68	35 - 85
White Oak		1	62	
Madrone	1		88	
Tan Oak		18	78	52.6 - 115.8
Chinquapin	1		95	
<b>Maternal-Post-Weaning n=2</b>				
Tree Species	Snag	Live Tree	Mean DBH	DBH Range
Douglas Fir	1		147	
Tan Oak		1	72	

Table 6. Quantity and species of trees used as natal or maternal dens by female fishers during 2006 and 2007 in the Sacramento Canyon study area.

Tree Species	Total Dens	Natal Dens	Maternal Dens	Mean DBH(cm)	Mean Height(m)
Douglas-fir -Snag	27%	0	4	89.66	14.40
Black oak -Snag	20%	0	3	45.13	13.51
Black oak -Live	13%	0	2	45.33	15.24
Incense-cedar- Live	7%	0	1	96.26	31.08
Incense-cedar- Snag	7%	0	1	91.44	9.14
White fir -Live	7%	1	0	66.04	33.22
Port Orford-cedar -Snag	7%	0	1	112.52	17.06
Ponderosa pine -Snag	7%	0	1	73.66	10.36
Unspecified Conifer Snag	7%	1	0	67.56	10.36
	100%	2	13		

Table 7. Quantity and species of trees used as natal or maternal dens by female fishers during 2006 and 2007 in the Hayfork Summit study area.

Tree Species	Total Dens	Natal Dens	Maternal Dens	Mean DBH(cm)	Mean Height(m)
Black oak -Live	54%	5	20	53.34	15.14
Live oak -Live	17%	1	7	102.10	15.27
Douglas-fir -Snag	13%	0	6	119.43	20.82
Douglas-fir -Live	7%	1	2	129.79	36.78
Black oak -Snag	2%	0	1	37.33	9.44
Live oak -Snag	2%	0	1	43.94	4.87
Live oak -Dead limb fall	2%	0	1	N/A	N/A
Big Leaf Maple	2%	0	1	30.98	13.71
	100%	7	39		

Table 6. Diameter at breast height (1.37 m) in centimeters for conifer and hardwood rest sites used by fisher on three study areas in California, 1992-1996.

Tree Type	Study Area	n	$\bar{x}$	SD	Range	Median
Conifer	Eastern Klamath	215	77.2	46.7	8-196	63.8
	North Coast	136	105.8	42.4	12-205	111.5
	Southern Sierra	176	111.7	49.7	28-433	106.0
Hardwood	Eastern Klamath	38	49.3	27.7	12-132	44.6
	North Coast	35	87.1	28.3	42-149	77.0
	Southern Sierra	141	65.0	21.6	30-145	63.0

Table 7. Habitat characteristics surrounding fisher rest sites located on three study areas in California from 1992-1996.

Variable	Study Area	<i>n</i>	$\bar{x}$	SD	Range	Median
Basal Area (m/ha <sup>2</sup> )	Eastern Klamath	289	59.8	30.9	9.2-169.0	54.8
	North Coast	127	75.6	27.6	9.2-161.7	73.9
	Southern Sierra	285	62.6	26.1	9.2-129.3	64.7
Mean Tree DBH (cm) <sup>a</sup>	Eastern Klamath	293	46.2	28.2	6.8-236.4	39.5
	North Coast	127	118.3	35.6	40.2-198.7	119.2
	Southern Sierra	285	89.6	29.5	24.0-176.2	87.2
Canopy Closure (%)	Eastern Klamath	298	88.2	12.8	3.0-100.0	95.4
	North Coast	127	93.9	7.5	65.2-100.0	96.7
	Southern Sierra	291	92.5	9.1	39.7- 99.9	95.4

<sup>a</sup> Mean tree diameter at breast height (DBH, 1.37 m) calculated for the four largest trees at rest sites; the rest site tree was included if it was among the four largest.

Table 1. Values associated with resting locations of radio-collared fisher at various study areas in California and southern Oregon

Study Area	Source	n Indiv Fisher	Rest Tree Type	n Structure	Average dbh of Rest Tree (in)	StDev of Rest Structure (in)	Average QMD <sup>a</sup> of Rest Site (in)	StDev of Rest Site QMD (in)
Southern Oregon Cascades	Aubry and Raley 2006	19	Live Tree	259 <sup>b</sup>	25.1 males 34.6 females			
			Snag	54 <sup>c</sup>	47.6 males 44.9 females			
North Coast (Six Rivers)	Zielinski et al. 2004a	22	Hardwood	32	34.5	11.9		
			Conifer	64	49.1	14.9		
			Snag	50 <sup>d</sup>	46.8	12.9		
			Log	10	37.4	17.4		
Coastal Klamath Province (Hoopa)	Yaeger 2005	19	Hardwood	86	29.6	10.2	14.4	5.5
			Conifer	52	43.1	15.9		
			Hardwood snag	5	28.7	9.0		
			Conifer snag	7	45.1	19.3		
			Conifer Log	5	36.6	2.6		
Interior Klamath Province (Trinity Lake)	Yaeger 2005	19	Hardwood	26	28.3	10.7		
			Conifer	154	38.8	16.1		
			Hardwood snag	4	26.6	6.6		
			Conifer snag	18	39.5	11.9		
			Conifer Log	9	92.3	19.8		
Interior Klamath Province (Weaverville)	Self pers comm.	9	Hardwood	11	29.8	15.0	11.0	1.7
			Conifer	10	29.8	11.8		
			Conifer Snag	4	43.8	3.3		
Interior Klamath Province (Castle Creek)	Self and Kerns 2001	3	Conifer	23	29.9	12.5	13.3	3.0
			Hardwood	4	21.0	2.6		
			Snag	5	41.0	14.0		
			Log	2	38	-		
Southern Sierra Nevada <sup>e</sup>	Zielinski et al. 2004a	23	Hardwood	146	25.6	8.4		
			Conifer	70	43.4	14.9		
			Snag	93 <sup>c</sup>	47.4	20.0		
			Log	33	51.8	36.1		
Southern Sierra Nevada	(Mazzoni 2002)	9	Live Tree	53	37.5	11.0		
			Snag	9	40	17.5		

<sup>a</sup> - QMD calculations do not include rest structure

<sup>b</sup> - less than 2% hardwood

<sup>c</sup> - n = 3 hardwoods

<sup>d</sup> - conifer only

<sup>e</sup> - giant sequoias removed from calculations of dbh

dbh-diameter breast high (4.5ft above ground)

StDev-Standard Deviation

in-inches

QMD-Quadratic Mean Diameter

From page 9 [10] of Candidate Conservation Agreement with Assurances for Fisher for the Stirling Management Area, between Sierra Pacific Industries and U.S. Fish and Wildlife Service, signed May 15, 2008, 33 pages.