

Black Bear Conservation Plan for California

April 2024

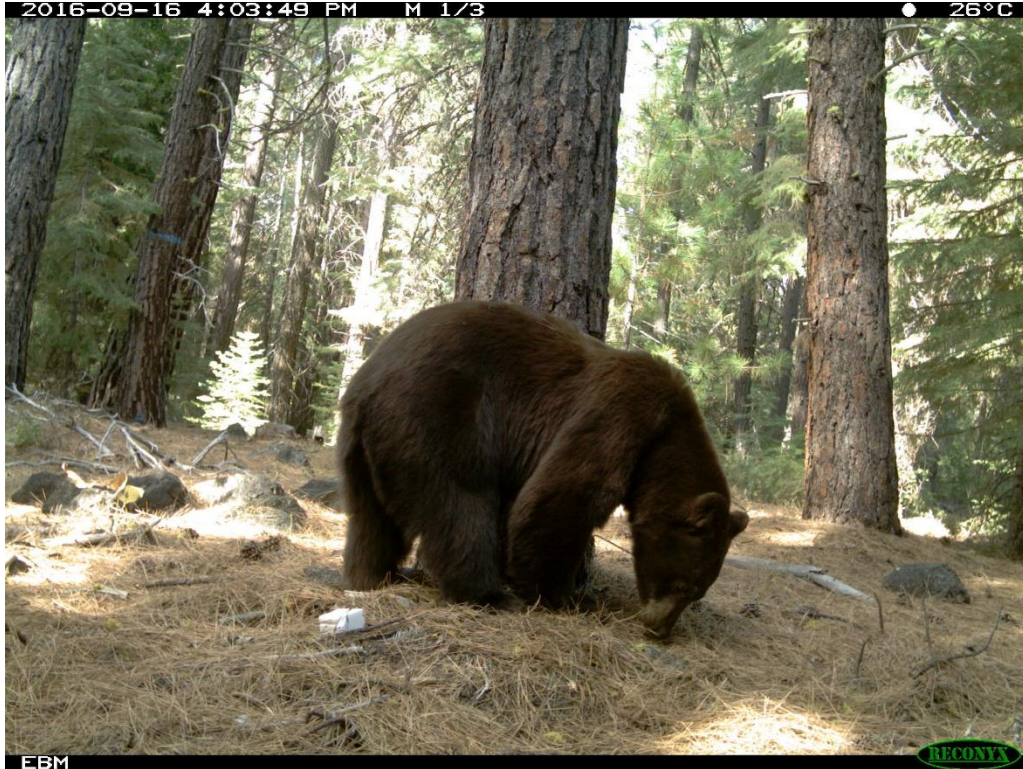


Photo: CDFW Ecoregional Biodiversity Monitoring Project, Northern Region. Camera traps are one of the science tools used to monitor black bear populations throughout California, and this information is used to guide black bear conservation.



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- 9 [Authors and Acknowledgements]
 - 10 [Statement from CDFW Director]

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90 Chapter 1. Introduction

91 The American black bear (*Ursus americanus*) is an iconic species that garners a high
92 degree of public interest in California, as it does across North America (Graber and White
93 1983, Klip 2012). The relationship between black bears and people is complex, however,
94 and public attitudes and opinions concerning black bears are diverse (Siemer et al. 2023).
95 Black bears are highly valued for various reasons. For example, black bears are culturally
96 significant to many Native American Tribes, are a favored game species to many hunters,
97 are sought after for viewing and photography opportunities, and are widely recognized for
98 their intrinsic value and ecological role as an omnivorous predator. Black bears can also
99 be a source of conflict when they use areas of high human activity (i.e., they become
100 habituated to people), seek out anthropogenic food sources and cause property damage
101 (i.e., they become food-conditioned), prey upon livestock, contribute to reducing ungulate
102 populations (Monteith et al. 2014, Wittmer et al. 2014) below desired management
103 thresholds, or threaten public safety through aggressive or predatory behavior (Hopkins et
104 al. 2010). Given the diverse array of values surrounding black bears, a comprehensive
105 statewide plan guiding their conservation is necessary.

106 It is difficult to define the differences between wildlife conservation and management,
107 however, the former terminology is broader than the latter, such that conservation can
108 include management. Further, Fish and Game Code (FGC) 1801 declares wildlife
109 “conservation” a policy for California. For these reasons, this document is referred to as a
110 “conservation plan” which considers both passive and active management strategies for
111 maintaining black bear populations throughout California while mitigating sources of
112 human-black bear conflict (HBC).

113 The previous black bear “management plan” of the California Department of Fish and
114 Wildlife (CDFW) was developed more than two decades ago (CDFW 1998) when black bear
115 population size estimates were based on less contemporary methods than what is
116 currently available. Until recently the CDFW applied an indirect population modeling
117 approach using age information inferred from tooth samples collected annually by hunters
118 (Fraser 1976). While annual age data remains an important source of information, this
119 modeling approach has long been recognized to be error prone, especially when there are
120 changes in hunter effort and other analytical assumptions (Harris and Metzgar 1987). At an
121 April 2022 meeting of the Fish and Game Commission (“Commission”), the CDFW
122 presented preliminary results of an updated, more accurate, integrated population
123 modeling approach to make better use of black bear age data and other data sources

124 (CDFW 2022b) and committed to revise its management plan to include details about
125 improved black bear population monitoring.

126 CDFW is the state trustee agency responsible for the conservation of wildlife and their
127 habitats (FGC 1802). It is charged with implementing and enforcing regulations set by the
128 Commission, as well as providing biological data and expertise to inform Commission
129 decision-making on a wide variety of issues affecting wildlife. The Commission enacts
130 wildlife regulations in a manner that considers information on populations, habitat, food
131 availability, and animal welfare (FGC 200-203). Issues of regulation include recreational
132 harvest, use of protected areas, permitting of wildlife rehabilitation facilities, and listing of
133 species under the California Endangered Species Act, among others. State policy set by
134 the legislature recognizes a balance between protecting wildlife for their intrinsic and
135 ecological values; providing for beneficial and recreational uses including regulated
136 hunting; and mitigating economic, human safety, and public health damages caused by
137 wildlife (FGC 1801). An essential concept recognized in this policy is that wildlife is a
138 renewable resource and that, through regulated management, abundant and thriving
139 populations can be perpetuated.

140 Through California Executive Order B-10-11(2011), state policy reaffirmed that California
141 Native American Tribes have sovereign authority over their territories and activities, and
142 thus cross-jurisdictional issues require effective government-to-government consultation
143 between state agencies and Tribes. The policy of the CDFW is to notify and consult with
144 Tribes regarding proposed activities affecting fish, wildlife, and plant resources and other
145 Tribal interests, and to encourage collaborative relationships resulting in co-management
146 of resources, such as black bears (CDFW 2014).

147 Black bears are classified as a game mammal in California (FGC 3950) such that regulated
148 hunting of the species includes licensing, fees, harvest season and area, and other
149 restrictions (14 CCR 365, 366, 367.5, FGC 4750-4763). The CDFW also manages black
150 bears associated with HBC, which may include issuing lethal depredation permits when
151 non-lethal efforts to address problems prove ineffective (FGC 4181, CDFW 2022a). The
152 current decision-making process for addressing HBC and other related issues such as
153 animal welfare is described in a policy developed by CDFW (2022a).

154 Regulated hunting has been a central component of wildlife conservation in California and
155 throughout North America for over a century (Geist et al. 2001, Organ et al. 2012). For
156 example, CDFW conservation activities that benefit both game and non-game species
157 alike (e.g., population monitoring, research, land acquisition, habitat improvement, law

158 enforcement etc.) are substantially funded by revenues generated from hunting license
159 fees and from taxes on firearms and ammunition pursuant to the Pittman–Robertson
160 Federal Aid in Wildlife Restoration Act of 1937. Additionally, partnerships between CDFW
161 and hunting-focused non-government organizations (NGOs) play important roles in habitat
162 creation and protection that benefit a wide variety of species. Specific to black bears,
163 hunters also provide CDFW with tooth samples from harvested animals. Age estimates
164 from these samples constitute a key source of scientific data that is critical to efficient
165 estimation and monitoring of black bear populations throughout California.

166 Changing societal views towards hunting highlight the need for wildlife managers to ensure
167 they are adequately considering the perspectives of non-hunters (Peterson and Nelson
168 2017). Wildlife managers have also been criticized for undervaluing the perspectives and
169 contributions of Native Americans—both those that hunt and those that do not—to wildlife
170 conservation (e.g., Hessami et al. 2021). Recognizing these concerns, the Commission has
171 a policy statement addressing justice, equity, diversity, and inclusion that acknowledges
172 prejudices and barriers experienced by historically marginalized and underserved
173 communities regarding access to nature and regulatory decision-making processes (FGC
174 2022). This policy commits the Commission to a set of actions for correcting these
175 inequities. The CDFW shares this goal; it will seek to broaden input beyond traditional
176 constituencies while continuing to value hunting as an important tradition and
177 management tool.

178 In consideration of the background and history summarized above, CDFW’s goals for black
179 bear conservation apply to both black bears and people:

180 **Black Bear Conservation Goals:**

- 181 1. Conserve black bear populations that are abundant, disease-resilient, and
182 genetically diverse statewide and regionally, and conserve and enhance their
183 habitats.
- 184 2. Provide opportunities for black bear hunting, viewing, and public education;
185 minimize human-black bear conflict; consider animal welfare in black bear
186 conservation; and be inclusive of all Californians in black bear conservation
187 decisions.

188 CDFW’s approach to achieving these goals includes monitoring black bear populations
189 and using these data in an adaptive and structured decision-making process to inform
190 conservation actions and policies about hunting, other human interactions with black

191 bears, and responses to climate change, land use, and other conservation stressors. This
192 black bear conservation plan includes background on black bear biology (Chapter 2) and
193 the ecological and social framework for black bear conservation (Chapter 3), describes the
194 monitoring and modeling approach for tracking black bear populations (Chapters 4 and 5),
195 explains how this information will be applied in decision making (Chapter 6), and lists the
196 resources and next steps needed to successfully implement the plan (Chapter 7). Specific
197 recommendations about hunting rules (e.g., tag quotas, season dates, methods of take)
198 for black bears will not be made in this plan. However, the information in this plan and the
199 implementation thereof will inform future regulations to establish or adjust hunting
200 seasons for black bears (FGC 302). Additionally, those rule changes generally require
201 changes to Title 14 regulations by the Commission or statutory changes to Fish and Game
202 Code by the California Legislature.

203 **Chapter 2. Black Bear Biology and Ecology**

204 **2.1 Physical Characteristics**

205 Black bears are large, heavily built carnivores. Adult females typically weigh between 45
206 and 90 kg, and adult males typically weigh between 70 and 160 kg, with some individuals
207 exceeding 220 kg (Lariviere 2001). Bears in excess of 300 kg have been found in places
208 where anthropogenic food sources are abundant. Pelage color is generally uniform and
209 varies from cinnamon, tan, brown, or black. White patches may occasionally occur on the
210 chest (Lariviere 2001).

211 **2.2 Denning**

212 Black bears typically hibernate during the winter months in response to a seasonal
213 shortage of food. In contrast to other winter-hibernating mammals that reduce their
214 metabolic rate by >90% and body temperature to near 0° C (e.g., rodents), black bears only
215 reduce their metabolic rate by 20-50% and maintain a near normal body temperature,
216 which allows them to quickly react to danger (Hellgren 1998, Stenvinkel et al. 2013). Other
217 hibernating mammals are slow to arouse because they must gradually warm themselves.

218 During hibernation, black bears remain inactive without eating, drinking, urinating, or
219 defecating. This too differs from other hibernating mammals, which must arouse every 4-
220 10 days to feed, defecate, and urinate (Folk et al. 1976, Hellgren 1998). Hibernating
221 animals recycle waste products (e.g., urea), preserve muscle and bone mass, and do not
222 acquire bed sores—adaptations that are of interest to medical practitioners seeking to
223 improve human health in areas such as heart and kidney disease, muscle wasting, obesity,
224 osteoporosis, etc. (Stenvinkel et al. 2013, Berg von Linde et al. 2015). Under the
225 constraints of hibernation, adult female black bears also experience the physiological
226 demands of gestation, parturition, and lactation, which other hibernating mammals do not
227 experience.

228 Most black bears in California hibernate each year, but if sufficient food resources are
229 available some black bears, particularly males, may remain active all winter (Graber 1989).
230 Black bear dens are often in tree cavities, rock or brush piles, underground burrows, or
231 open-ground beds (Lariviere 2001). In California, other common documented den sites are
232 talus slopes and cavities in downed logs or at the base of trees (Graber 1982, Koch 1983,
233 Braden 1991, Stafford 1995). Occasionally, black bears sometimes den in anthropogenic
234 structures (e.g., crawl spaces and under decks, Schafer et al. 2018).

235 **2.3 Reproduction**

236 Litters of 1-4 cubs are born during January-February. Mothers and cubs typically emerge
237 from their dens during April-May. Cubs remain with their mothers through the following
238 winter, and then separate prior to the breeding season (e.g., June-July). In total cubs
239 remain with their mothers for approximately 16 months (Lariviere 2001).

240 Reproductive success in female black bears is related to abundance and availability of
241 quality food (Elowe and Dodge 1989, Costello et al. 2003). As adult female nutrition
242 increases, reproductive parameters likely change in the following order: litter size
243 increases, age of first reproduction decreases, yearling survival increases, cub survival
244 increases, and interbirth interval decreases (Noyce and Garshelis 1994).

245 Adult females generally breed every other year but may breed in consecutive years if a litter
246 is lost. Reproductive parameters of black bears in California are generally unknown
247 outside of Yosemite National Park, where Graber (1982) and Keay (1990) reported mean
248 litter sizes ranging from 1.6 to 2.0, a mean age of first reproduction of 4.2 years, and a
249 mean interbirth interval of 2.5 years.

250 **2.4 Mortality**

251 Mortality rates for black bears are relatively high during the first few years of life (18-47%;
252 Kolenosky 1990) and common causes of death include cannibalism, starvation, and
253 abandonment (LeCount 1987, Elowe and Dodge 1989). Once adulthood is reached,
254 mortality rates decrease substantially, in part because adult black bears have few natural
255 predators and are relatively unaffected by parasites and disease (Rogers 1983).
256 Anthropogenic causes of mortality (e.g., hunting, vehicle collisions, management
257 removals) are the dominant causes of mortality for adult animals in both areas where
258 harvest is allowed and where it is not, but overall rates of mortality are generally low and
259 sustainable (Gantchoff et al. 2020). Adult female mortality rates are usually lower than
260 those of adult males. Estimates of black bear survival rates and causes of mortality in
261 California have not been reported in recent years.

262 **2.5 Food Habits**

263 Black bears are omnivores, and their teeth are adapted for feeding on both plant and
264 animal matter. They are highly opportunistic and will eat nearly anything edible. Black bear
265 food habits vary widely with season and location. In general, following emergence from
266 winter dens in spring, black bears forage on green grasses and forbs, insects, and carrion.

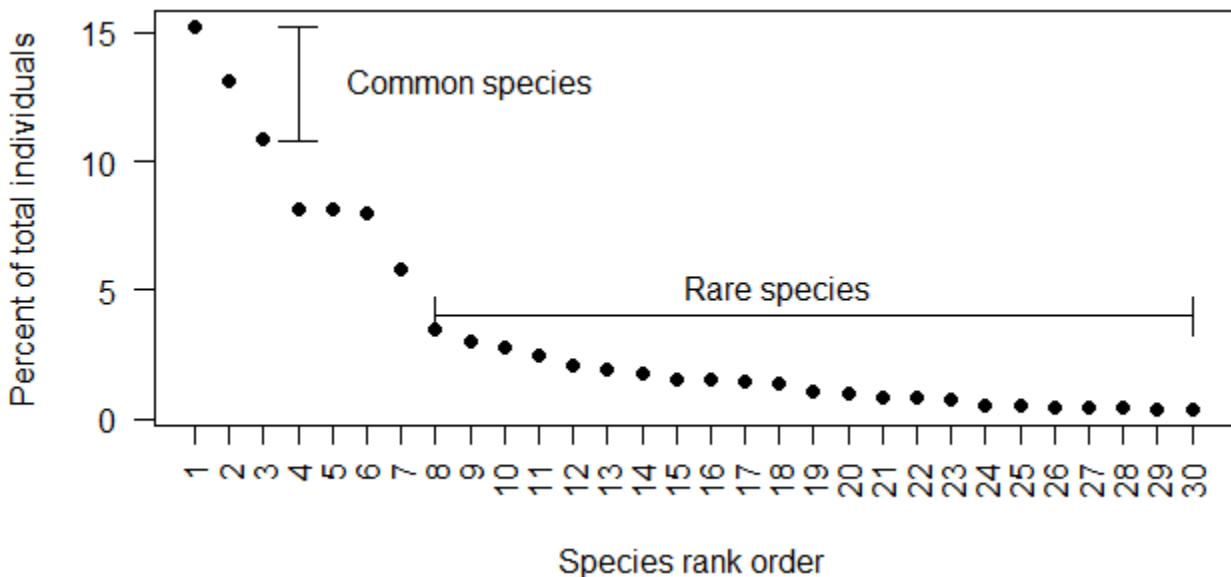
267 Black bears shift to eating berries when they become available (Graber 1982, Grenfell and
268 Brody 1983) and focus on mast crops such as acorns (*Quercus* spp.) in the fall. Where
269 present, manzanita berries (*Arctostaphylos* spp.) are an important food resource during
270 late summer and fall (Kelleyhouse 1980), as are sugar pine (*Pinus lambertiana*) seeds
271 (Mazur et al. 2013). While the diet of black bears is mostly comprised of vegetation, they
272 may prey upon newborn ungulates in the spring (Zager and Beecham 2006, Monteith et al.
273 2014) and scavenge the kills of mountain lions (*Puma concolor*) year-round, including
274 during the winter (Elbroch et al. 2015, Allen et al. 2021). The opportunistic foraging
275 behavior of black bears often brings them into conflict with people, as black bears will
276 damage property such as homes and storage sheds while seeking out human food and
277 garbage, damage agricultural crops, and occasionally kill livestock, primarily chickens
278 (CDFW unpublished data).

279 Chapter 3. Conservation Framework

280 The framework for black bear conservation in California includes a mix of ecological and
281 social factors. This chapter summarizes background information relevant to the
282 conservation goals introduced in Chapter 1.

283 3.1 Population Abundance

284 It is a goal of the California Department of Fish and Wildlife (CDFW) to conserve abundant
285 black bear populations because of their ecological role among the carnivore species that
286 inhabit California. Common, abundant species tend to have large, widespread ranges
287 (Lawton 1993), and there tend to be a few common species versus many rare species
288 within any ecological community of animals or plants (Preston 1948, Fig. 1).



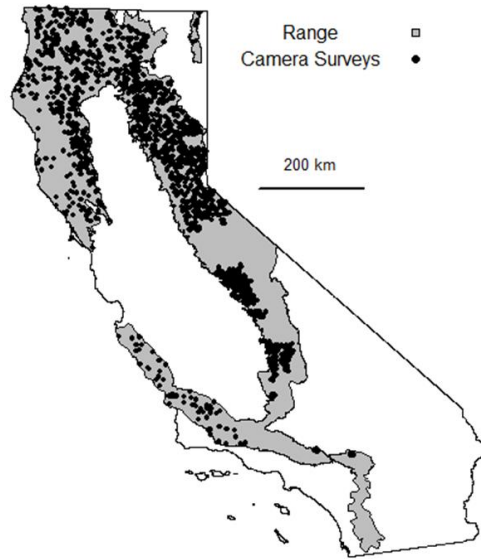
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290 Figure 1. Commonness and rareness of wildlife species. As illustrated in this simulated example, ecological
291 theory and empirical data demonstrate that there are usually a few common, abundant species versus
292 many rare, less abundant species. In California, black bears are an example of a common, abundant
293 species.

294 Black bears are widespread and common throughout most forested habitats of California;
295 they are one of the most commonly occurring large mammal species in California forests
296 (Furnas et al. 2022). Occupancy modeling is a statistical approach for analyzing the
297 proportion of locations a species occurs at to assess its relative abundance with respect to
298 other species (MacKenzie et al. 2006). The geographical range of black bears in California
299 cover 39% of the state's land area and the average probability of bear occurrence at any

300 point within this range for a month sampling period is estimated at 63% based on
301 occupancy analysis of detections from camera surveys at 2,954 locations (Fig. 2, Furnas et
302 al. 2022). In comparison, examples of less widespread and common carnivores in
303 California include Pacific fisher (*Pekania pennanti*, range=29%, occupancy<20%) and red
304 fox (*Vulpes vulpes*, range=16%, occupancy<1%) (CDFW unpublished data).

305 Black bear densities, however, are not evenly distributed throughout the species' range in
306 California. Roughly half of the statewide black bear population resides in the North Coast
307 and Cascade regions (see Fig. 8 for regional locations). Studies indicate that black bear
308 densities have ranged from 38 to 96 black bears per 100 km² (Piekielek and Burton 1975,
309 Kelleyhouse 1977, California Department of Fish and Game 1993) in these regions. About
310 40% of the black bear population inhabits the Northern and Southern Sierra regions.
311 Density is less than in the North Coast and Cascades regions, with estimates of 19 to 38
312 black bears per 100 km² (Sitton 1982, Grenfell and Brody 1983, Koch 1983). Fusaro et al.
313 (2017) reported that density within the town of Mammoth Lakes (38 black bears per 100
314 km²) was 3 times greater than in a nearby wildland study area, Slinkard Wildlife
315 Management Area. The remainder of the black bear population inhabits other areas of the
316 state including the South Coast region, where densities are probably less than 10 black
317 bears per 100 km² (Stubblefield 1992, Novick et al.1981, Moss 1972). The highest reported
318 recent black bear densities from California are 133 black bears per 100 km² on the west
319 side of the Hoopa Valley Reservation (Matthews et al. 2008) and 84 bears per 100 km² in
320 the Lake Tahoe basin (Owens-Ramos et al. 2022). These densities are among the highest
321 recorded for black bears across their range, with the densest known population inhabiting
322 southeastern Alaska (155 black bears per 100 km²; Peacock et al. 2011).



323

324 Figure 2. Locations of ~ 3,000 camera trap surveys, 2009-2022, throughout black bear range in California.

325 Common species, such as black bears in California, have substantial effects on the
 326 broader ecological community such that the conservation of common species should be
 327 considered alongside concerns about rare species (Gaston and Fuller 2007). The
 328 abundance of black bears in California is likely driven by their diverse, omnivorous diet and
 329 ability to use many different habitat types and seral stages as a generalist species, and
 330 their adaptability to varied environmental conditions over time (Garshelis et al. 2020b).
 331 Due to their abundance and ecological role, black bears may serve as a potential indicator
 332 species for guiding wider conservation efforts as demonstrated by their foraging ecology
 333 (Steenweg et al. 2023), use of large woody debris (Mitchell and Powell 2003), association
 334 with wildfire (Furnas et al. 2022), and habitat associations with many other species (Cox et
 335 al. 1994, Simberloff 1999). For all of these reasons, it is important that black bears remain
 336 abundant throughout their range in California.

337 Sustained and systematic monitoring of black bear abundance at statewide and regional
 338 scales is essential to effective conservation of black bears and other wildlife in California.
 339 Quantifying a desired population abundance of black bears is subjective and beyond the
 340 scope of this conservation plan, because it depends on both the ecological status of black
 341 bears and the needs of human society in a state of nearly 40 million inhabitants in 2023.
 342 On one hand, ecological considerations can be used to estimate the biological carrying
 343 capacity of how many black bears available habitats can support, although this number
 344 would be expected to fluctuate up and down from year to year with environmental cycles
 345 (McClelland et al. 2021). On the other hand, the needs and desires of people may define a

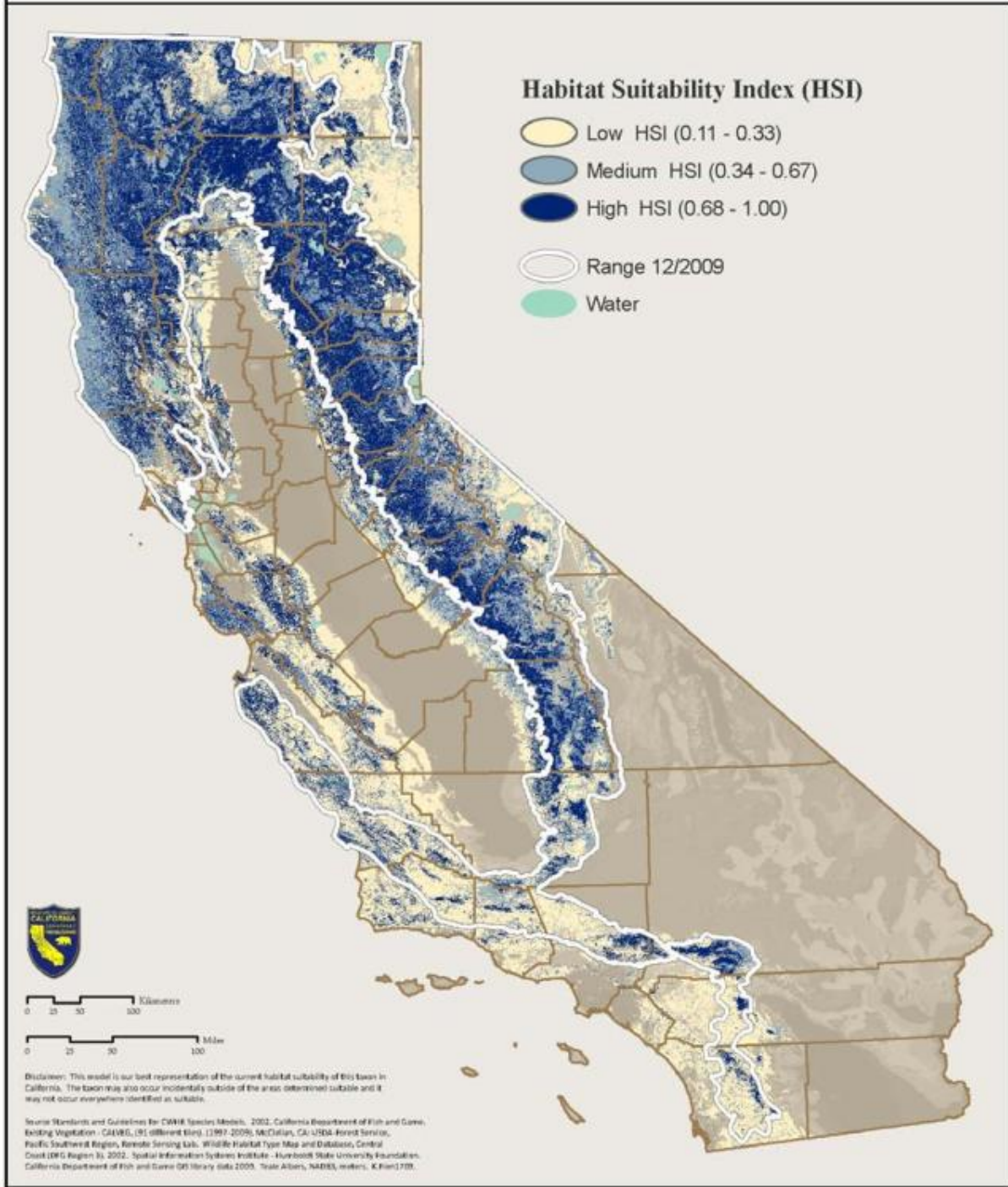
346 smaller, social carrying capacity of how many black bears human society is willing to
347 tolerate on the landscape (Decker and Purdy 1998, Cleary et al. 2021). As part of its
348 mission, CDFW is charged with balancing these potentially conflicting goals. As such,
349 CDFW intends to meet an ecological goal of maintaining abundant black bear populations
350 by ensuring that black bears remain common and widely distributed within secure, well-
351 connected habitats, and are not experiencing any long-term population declines of
352 conservation concern pursuant to either Fish and Game Code (FGC) 1801 or the California
353 Endangered Species Act.

354 **3.2 Habitat**

355 Black bears occupy most mountain ranges in California outside of the Mojave and Sonoran
356 deserts, and most of the 145,000 km² of forested habitat that is biologically suitable for
357 them (Fig. 3). Black bears continue to occupy the distribution first mapped by Grinnell
358 (1937), but expanded populations now also exist in areas where black bears were formerly
359 rare or absent, such as the Central Coast and the San Bernardino and San Gabriel
360 mountains of southern California. Range expansion in southern California is the result of a
361 translocation of black bears from Yosemite National Park to the San Bernardino mountains
362 in the 1930s, which resulted in a persistent population (Brown et al. 2009).

363 More recently, black bears appear to have expanded into other areas of California where
364 they were previously rare or absent, such as the Warner Mountains in Modoc County and
365 the Mayacamas Mountains of Sonoma and Napa Counties (Fusaro et al. 2017, CDFW
366 unpublished data). Range expansion has continued outside of California as well. In the
367 1980s black bears originating in California began recolonizing habitat in the Carson Front
368 of Nevada, where black bears had been absent for >80 years (Lackey et al. 2013, Malaney
369 et al. 2018, Sultaire et al. 2023).

AMERICAN BLACK BEAR HABITAT SUITABILITY
CALIFORNIA DEPARTMENT OF FISH AND GAME



370

371 Figure 3. Black bear distribution and habitat suitability in California.

372 Over half of the suitable black bear habitat in California is in public ownership, managed
373 primarily by the US Forest Service and National Park Service. Approximately 10% of
374 California's black bear habitat is managed as either wilderness or designated park. These
375 areas represent large blocks of undeveloped habitat and core areas within their habitat
376 where black bears encounter few humans. The abundance of black bear habitat in public
377 ownership where development is restricted provides an important buffer against habitat
378 loss. Because black bears are highly adaptable to living in human-modified environments,
379 human development along the wildland-urban interface in areas such as the Lake Tahoe
380 Basin is more of a concern for management of human-black bear conflict (HBC) than it is
381 for habitat loss and/or fragmentation negatively impacting black bear populations.
382 However, habitat enhancement using fire management and other methods may serve to
383 mitigate HBC (see Section 3.9).

384 **3.3 Genetic Diversity and Connectivity**

385 Overall, black bear populations appear to be genetically diverse throughout California.
386 Brown et al. (2009) identified 3-4 genetic clusters in a study of 504 black bears from across
387 California collected by hunters and researchers. The occupation of black bears in the
388 Central Coast region was hypothesized to have occurred relatively recently following a
389 release from competition with extirpated grizzly bears (*Ursus arctos*), and a range
390 expansion of black bears from the southern Sierra Nevada and Tehachapi mountains,
391 rather than from Southern California (Sherman and Ernest 2015).

392 Black bears in Northwestern California had the highest levels of genetic diversity, probably
393 as a result of connectivity with black bear populations in Oregon and throughout the
394 Pacific Northwest. Similarly, there was evidence of high genetic diversity and gene flow
395 among the interconnecting populations in Northern California and the Sierra Nevada
396 mountains. Black bears in the Southern California and Central Coast regions were
397 geographically isolated from larger populations to the north, but still maintained a similar
398 level of genetic diversity as other North American black bear populations (Brown et al.
399 2009, Clarke et al. 2001, Paetkau et al. 1998, Paetkau and Strobek 1994).

400 More recently, Sherman and Ernest (2015) studied the genetic diversity of black bears in
401 San Luis Obispo and Monterey Counties. Genetic diversity was lower than in other
402 populations in California but because the area had only recently been colonized by black
403 bears expanding from elsewhere, the authors concluded that management intervention
404 was not warranted.

405 **3.4 Disease**

406 Black bears are susceptible to many infectious and non-infectious diseases, most of
407 which do not significantly impact black bear populations. While there is no evidence that
408 disease is an important factor in California black bear population dynamics or population
409 health, there are some diseases of concern to monitor. These include emerging diseases
410 like sarcoptic mange (Niedringhaus et al. 2019) with an unknown risk to California's black
411 bear populations, zoonotic diseases that could affect people like trichinellosis
412 (Schellenberg et al. 2003), or diseases that could increase the likelihood of HBC like
413 idiopathic encephalitis (Alex et al. 2020). As such, disease, and health in general, is
414 important for black bear conservation at both the level of the individual black bear and the
415 population.

416 CDFW veterinarians investigate potential diseases in black bears opportunistically through
417 mortality investigations and actively through specific disease surveillance projects or
418 programs. Disease and mortality investigations consist of either a full necropsy with
419 postmortem workup and ancillary testing, or through targeted sample collection and
420 testing, depending on the situation. Currently, CDFW maintains an active research and
421 surveillance program for encephalitis in black bears. This emerging condition in California
422 and Nevada black bears potentially has more than one cause. It tends to affect young
423 black bears, often orphaned cubs of the year or yearlings. Clinical signs range from mild
424 changes in behavior and mentation that often mimic habituation, to overt neurologic
425 changes including head tilt, ataxia, tremors, and seizures. The disease is often seen in
426 black bears involved in conflict situations. CDFW also supports active surveillance of
427 *Yersinia pestis* in carnivores by providing samples from black bears and other carnivores to
428 the California Department of Public Health for serologic surveillance. Moreover, CDFW
429 continues both active and opportunistic surveillance for pesticides like anticoagulant
430 rodenticides, organophosphates, carbamates, and bromethalin in black bears. Pesticides
431 can be direct sources of mortality for black bears and public health risks to hunters as
432 some can accumulate in consumable portions like meat and fat.

433 In addition to ongoing mortality investigations and active surveillance projects in black
434 bears, there have been and continue to be several serology-based surveillance projects.
435 These projects utilize archived serum collected either from hunter harvest, depredation, or
436 management actions and measure antibody prevalence to various pathogens in one or
437 more of California's black bear populations. These projects confirm that California's black
438 bears are variably exposed to multiple different pathogens including, but not limited to,
439 *Toxoplasma gondii*, *Borrelia burgdorferi*, *Anaplasma phagocytophilum*, *Trichinella spiralis*,

440 canine distemper virus, canine adenovirus type 1, *Yersinia pestis*, *Trypanosoma cruzi*, and
441 *Francisella tularensis* (Mortenson 1998, Stephenson et al. 2015, CDFW unpublished data).
442 While serologic surveillance for antibodies is an important tool for disease and pathogen
443 surveillance, it is only informative about exposure to pathogens—not the presence or
444 absence of disease associated with pathogens.

445 CDFW continues to perform mortality investigations to support Law Enforcement and HBC
446 programs, and to investigate abnormal mortalities. Common causes of death include
447 trauma (thermal burns, gunshot, vehicle strike, or conspecific aggression being the most
448 common), infections (viral, fungal, bacterial, and parasitic), and neoplasia or cancer.
449 Infections are more commonly diagnosed in young black bears, especially cubs and
450 yearlings. Idiopathic encephalitis, canine adenovirus type 1, and generalized
451 dermatophytosis have been the most commonly diagnosed infections in recent years
452 (CDFW unpublished data). Generalized dermatophytosis is often indistinguishable from
453 sarcoptic mange and may be either a primary disease or secondary to some other infection
454 (e.g. *Ursicoptes* sp. or *Sarcoptes* sp. mite infestation) or immunosuppression (Clothier et
455 al. 2022). Trauma, particularly from vehicle strikes or gunshot wounds (e.g., sustained due
456 to depredation or other conflict behavior, or from poaching) or infections secondary to
457 trauma are more commonly seen in prime age adult black bears. With increasingly severe
458 wildfire activity associated with climate change, black bears with thermal burns from
459 wildfires are being seen more commonly, affecting young and old black bears alike.
460 Neoplasias are more commonly diagnosed in old black bears, and older sows may be
461 particularly susceptible to mammary gland tumors (CDFW unpublished data).

462 **3.5 Animal Welfare**

463 Animal welfare for black bears is defined in CDFW Bulletin Number 2022-01 Black Bear
464 Policy in California: Public Safety, Depredation, Conflict, and Animal Welfare as “the
465 physical, psychological, social, and environmental well-being of an animal.” It is CDFW’s
466 responsibility to consider animal welfare whenever managing black bears. In implementing
467 this policy, CDFW follows Bulletin Number 2018-02 Department of Fish and Wildlife
468 Animal Welfare Policy, which states that:

- 469 • Research, surveys, and experiments involving free-ranging and captive
470 invertebrates, reptiles, amphibians, fishes, birds, and mammals shall consider:
 - 471 ○ Whether the use of animals is necessary;

- 472 ○ The number of animals needed to obtain valid scientific data; and
- 473 ○ Methods to avoid or minimize pain, discomfort, and distress consistent with
- 474 sound research design and practice.

- 475 ● Animals shall be housed under conditions that are species-appropriate in
- 476 environments that are safe and secure for animals and staff.

- 477 ● Methods of euthanasia shall be consistent with current recommendations of the
- 478 American Veterinary Medical Association (AVMA) Panel on Euthanasia, unless
- 479 alternatives have been justified and approved by the appropriate CDFW Program
- 480 (Wildlife Branch, Fisheries Branch, or Marine Region).

481 One prominent example of how animal welfare concerns are addressed with black bears is
482 the care and rehabilitation of injured and orphaned black bears. In the absence of being
483 taken into captivity, most of these black bears would die. While these deaths will not result
484 in changes to black bear population health, the experiences of the black bears themselves
485 prior to their death would be unpleasant and there is substantial demand from the public
486 for wildlife managers to intervene in these situations (Beecham et al. 2016). Options
487 include non-intervention; humane euthanasia; reuniting black bears with their biological
488 mothers; fostering black bears to wild, adoptive females; transporting black bears to a
489 permanent captive facility; and transporting black bears to a rehabilitation facility for
490 eventual release (Beecham et al. 2015). CDFW veterinarians work with regional staff to
491 identify individual black bears that have been injured or orphaned and determine
492 appropriate interventions.

493 Animal welfare is also an important consideration in wildlife field research. Examples
494 include decisions regarding whether to externally mark (e.g., ear tags) or remotely monitor
495 (e.g., GPS collars) black bears, types of traps to be used, types of chemical immobilization
496 drugs to use, etc. In these cases, actions taken by researchers to better understand black
497 bear ecology have the possibility of causing distress, pain, or behavioral changes to black
498 bears. Thus, it is important that the negative impacts are weighed against the benefits.
499 Consequently, prior to initiating any research or monitoring program for black bears,
500 capture plans are developed and reviewed by CDFW veterinarians.

501 **3.6 Regulated Hunting**

502 Hunting regulations (e.g., the setting of seasons and methods of take, bag limits, etc.) in
503 the United States are the product of municipal, state, and federal laws that began as early

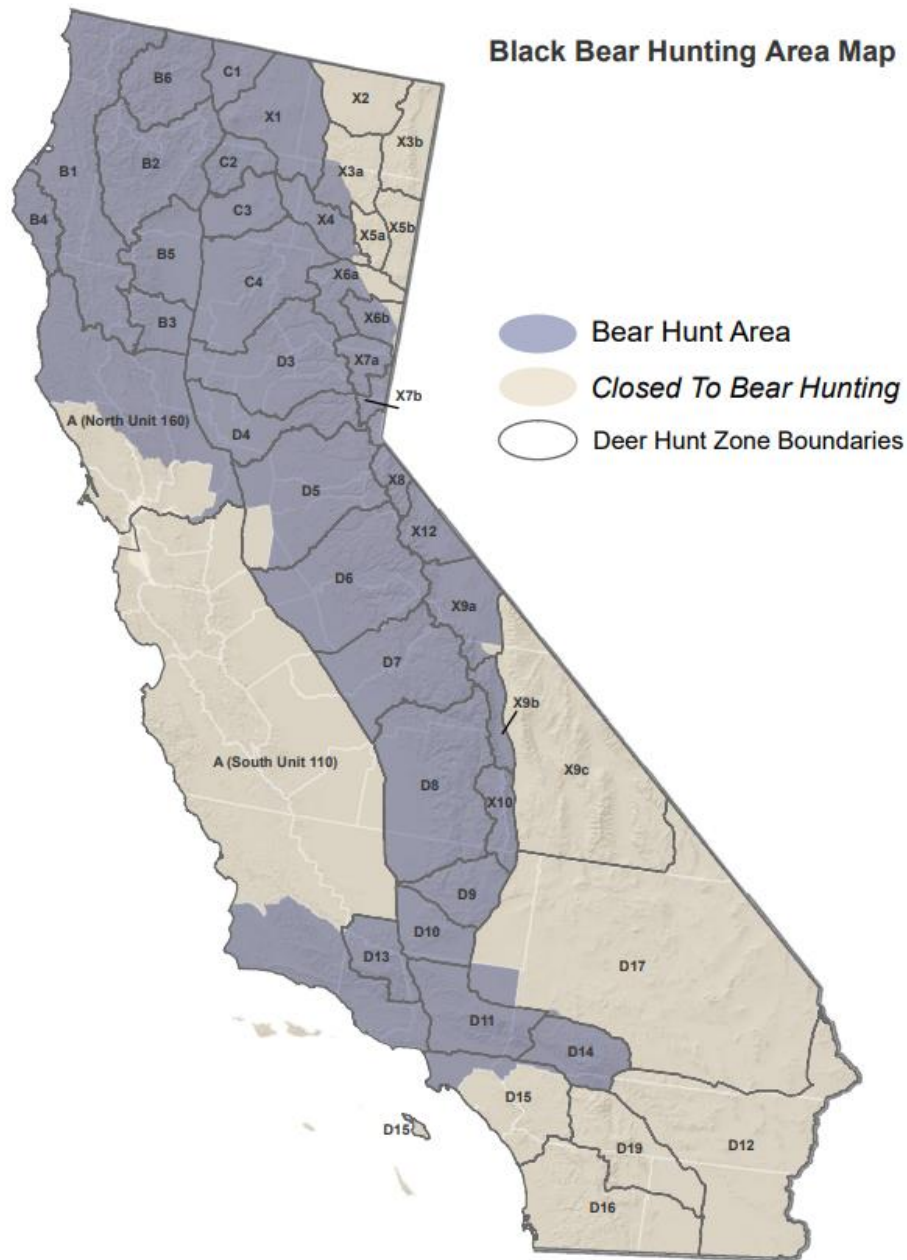
504 as 1646, when the colony of Rhode Island established a season for white-tailed deer
505 (*Odocoileus virginianus*) hunting and enforced penalties for hunting out of season (Organ
506 et al. 2012). However, expectations regarding how, when, and why wildlife was harvested
507 were implemented by indigenous people for thousands of years prior to the arrival of
508 Europeans (Eichler and Baumeister 2018).

509 Outside of National Park Service lands like Yosemite and Sequoia and Kings Canyon
510 National Parks, where the hunting and trapping of any species has been prohibited since
511 the late 1800s, the first formal regulations governing black bear hunting in California were
512 enacted in 1948, when black bears became classified as game animals. A license became
513 required for hunting and trapping, and a bag limit of two black bears per hunter was
514 established. Over time, regulations have generally become increasingly restrictive, both to
515 ensure black bear harvests are sustainable and to reflect changing public attitudes. For
516 example, recreational trapping was prohibited in 1961, the bag limit was reduced to one in
517 1968, harvest of cubs or females with cubs was prohibited in 1972, a quota limiting the
518 number of black bears harvested annually was initiated in 1990, and the use of dogs to
519 hunt black bears was prohibited in 2013.

520 Since 1957, successful black bear hunters have been required to submit report cards that
521 describe sex and age class of harvested black bears, along with the location and date of
522 harvest. Beginning in 1982, report cards became required of all tag holders, regardless of
523 success, and hunters were required to bring harvested black bears to the CDFW for tag
524 validation and removal of a premolar tooth, which is used to determine the black bear's
525 age in years. As discussed in Chapter 4, these samples are the key source of data utilized
526 by CDFW for estimating and monitoring black bear populations and their vital rates. As
527 demonstrated in California and elsewhere, the public (including hunters who provide age
528 information on bears) can contribute to conservation through scientific data collection that
529 supports population monitoring efforts (Cretois et al. 2020, El Bizri et al 2020, Candler et
530 al. 2022).

531 While black bears are widespread in California, hunting is not permitted in all areas that
532 black bears inhabit and is limited in others (Fig. 4). For example, approximately 19% of
533 occupied medium-high quality black bear habitat (hereafter, black bear habitat) is
534 comprised of National Parks in which black bear hunting is prohibited (4%) or is outside of
535 the black bear hunt zone (15%), such as the Warner Mountains in Modoc County. In
536 addition, 8% of black bear habitat within the hunt zone is comprised of roadless wilderness
537 areas where harvest is likely minimal because of logistical difficulties or the challenge of
538 packing out the meat, head, and hide. Collectively, these 36,751 km² (27% of all black bear

539 habitat) likely function as sanctuaries that provide a reservoir of adult females with
540 relatively high survival rates that produce dispersing offspring and contribute to hunted
541 populations (Beringer et al. 1998). However, protection from hunting may not necessarily
542 result in greater survival, and consequently, population growth rates. For example, in
543 un hunted black bear populations near carrying capacity, cub and yearling survival may
544 decrease in association with density dependent natural causes of death, such as
545 starvation, intraspecific competition, and predation (Schwartz et al. 2006, Obbard and
546 Howe 2008, Czetwertynski et al. 2007). These populations may also have high rates of HBC
547 (Fusaro et al. 2017).



548

549 Figure 4. California black bear hunting map.

550 Regardless of the difference in population dynamics in hunted vs unhunted populations,
 551 researchers generally agree that hunting is a mostly additive form of mortality in black
 552 bears. (Gantchoff et al. 2020) This, combined with their low reproductive rates, indicates
 553 that unless management objectives call for population reduction, harvest should be
 554 conservative to prevent overexploitation. Under optimal survival and reproductive rates,

555 the maximum sustainable annual hunting mortality rate for black bears has been
556 estimated to be 15.9% (Miller 1990), although Pennsylvania, Virginia, and Wisconsin have
557 reported increasing black bear populations with harvest rates >20% (Hristienko and
558 McDonald 2007).

559 Based on current best estimates of black bear populations statewide and regionally,
560 hunters harvest less than 7% annually of the bears present in any region of the state, and
561 under 3% overall (see Section 4.2). This harvest rate is considerably lower than the
562 maximum sustainable harvest rates discussed above and is also lower than recent harvest
563 rates in nearby states such as Oregon (ODFW 2022) and Washington (WDFW 2022). In
564 some regions, the actual harvest rate may be as low as 1% of the black bear population.
565 Most harvest occurs in Northern California where bear densities are highest (i.e., Shasta,
566 Trinity, Siskiyou, and Mendocino Counties), which typically accounts for 35-40% of the
567 overall state harvest (CDFW 2021, CDFW unpublished data).

568 Over the last 10 years (2012-2022), an average of 28,024 black bear tags were sold
569 annually which, when including the cost of a hunting license, generated \$27.2 million in
570 revenue, ranging from \$1.9 to \$3.2 million per year. It should be noted that many of these
571 licenses are purchased by hunters who hunt other species or purchase other tags (e.g.,
572 deer tags). Still, black bear tags alone generated \$13.4 million in revenue, ranging from
573 \$1.2 million to \$1.6 million per year. Additionally, pursuant to the Pitman Robertson Act of
574 1937, a federal tax on firearms and ammunitions sales allocates between \$10 and \$30
575 million per year to game species conservation in California. CDFW uses a portion of these
576 funds to staff its conservation and hunting programs for black bears and other game
577 species. For example, over the last 10 years (2012-2022), CDFW used \$4.3 million of these
578 state and federal funds for staff working on black bear conservation and for a variety of
579 black bear research projects including some of the local density studies listed in Section
580 4.2 that CDFW is integrating into its updated population monitoring approach.

581 Since at least the 19th century sportsman's associations have promoted hunter ethics in
582 North America. This includes concepts of fair chase, appreciation of nature, humane killing
583 methods that avoid unnecessary pain and suffering, and avoiding waste of harvested
584 animals (Organ et al. 1998). CDFW promotes ethical hunter behavior through hunter
585 education programs, which hunters are required to take prior to obtaining hunting licenses.

586 California's first hunter education law was enacted in 1954. Classes are offered
587 throughout the State by more than 1,000 certified volunteer instructors, often CDFW game
588 wardens. Along with curricula focusing on understanding firearm equipment, shooting and

589 hunting skills, and safety, there is additional content on being a responsible and ethical
590 hunter. Students discuss (and perhaps even debate) the concept of fair chase, which is
591 defined by law, regional differences in ethical standards (e.g., hunting seasons and
592 methods of take vary by US state) and learn how and why hunting laws are passed. Hunting
593 ethics, which generally covers behavior that has to do with issues of fairness, respect, and
594 responsibility not covered by laws are also discussed. Students learn that not everyone will
595 agree on what is considered ethical hunting and thus it is important for each individual to
596 develop their own personal code of conduct. To aid in this development, discussions might
597 include questions the law does not address such as (1) at what distance should a shot be
598 taken, considering the distance, hunter skill level, and personal convictions regarding
599 whether the shot is a fair one? (2) is shooting birds on the ground, on water, or in trees
600 acceptable? or (3) how much should one share with strangers about the locations of
601 quality hunting locations on social media (i.e., hotspotting)? Collectively, discussions
602 about hunting ethics can be summarized by the statement, “Just because you can, does
603 not mean you should.”

604 Beyond basic hunter education courses, the CDFW promotes ethical hunter behavior
605 through advanced hunting clinics that are specific to the game being targeted (e.g., turkey,
606 upland game, waterfowl, and big game). Topics covered in each clinic include type of
607 firearm, ammunition, importance of sighting in the firearm, gauging distance, scouting,
608 tracking, field dressing, shoot-don't shoot scenarios, hunter ethics, landowner-hunter
609 relationships, conservation, and safety. The goal of this series of hunting clinics is to
610 develop ethical, conservation-minded, successful hunters through education, taking the
611 hunter a step beyond the basic hunter education course.

612 Examples of regulations that have attempted to address ethical hunter behavior with
613 respect to black bears include prohibition of (1) the use of traps (FGC § 3011), (2) the use of
614 bait (14 CCR § 365), and (3) the harvest of cubs and females accompanied by cubs (14
615 CCR § 365). Many regulations are in place that describe requirements for firearms and
616 archery equipment that promote humane harvest and fair chase (e.g., centerfire rifle
617 cartridges are required, shotguns may hold no more than 3 shells, there are draw weight
618 requirements for bows, etc.) (14 CCR § 353 and 354). Other examples of regulations
619 promoting fair chase include hunting and shooting hours restrictions (14 CCR § 352),
620 prohibition on taking big game with the aid of artificial light (14 CCR § 353), and regulations
621 related to the use of motorized equipment while hunting (FGC 3003.5, CCR 251). To avoid
622 needless waste, hunters are prohibited from leaving any portion of meat normally eaten by
623 people in the field (FGC § 4304). Because the sale of black bear parts is considered both

624 unethical and unlawful, the possession of >1 black bear gall bladder is considered “prima
625 facie evidence that the bear gall bladders are possessed for sale” (FGC § 4758).

626 Cultural, societal, and demographic changes have resulted in a declining participation in
627 hunting and fishing in California since the 1970s. Recognizing the importance of sustaining
628 interest in the hunting tradition, CDFW began state-wide participation in the federal
629 Recruitment, Retention and Reactivation (R3) program in 2017, with the aim of increasing
630 statewide hunting and fishing participation by collaborating with diverse stakeholders to
631 transform barriers into opportunities (CDFW 2019). Stakeholders cooperating with the
632 CDFW in this program include Tribes, non-governmental organizations, clubs, media,
633 industry, educators, and members of the public. An important component of the R3
634 program is to address barriers to participation, focusing beyond traditional hunter
635 education and community outreach efforts that have existed for decades, by becoming
636 socially relevant and creating spaces where both traditional hunting and fishing identities
637 are celebrated, and new identities, inclusiveness, and difference are embraced.

638 **3.7 Viewing**

639 Black bear viewing has long been a popular activity with visitors to National Parks in
640 California, such as Yosemite and Sequoia and Kings Canyon. As described by Graber and
641 White (1983) in a study of black bear food habits in Yosemite, “The sight or sound of a 100
642 to 200 kg beast poking around one’s camp in the gloom of night has provided a thrill tinged
643 with varying degrees of terror to generations of tourists.” Black bear viewing has been
644 associated with terms such as ecotourism or sustainable tourism, which is often
645 considered an important way to increase tourism through encouraging the public to visit
646 local environments and natural surroundings with a focus on environmental education and
647 ecological conservation (Stronza et al. 2019, Streimikiene et al. 2021). Most black bear
648 viewing in California likely occurs in largely undeveloped National Parks, but some semi-
649 urban areas such as Lake Tahoe and Mammoth Lakes, are popular destinations for black
650 bear viewing as well (Klip 2012).

651 In contrast to hunting, black bear viewing is considered a non-consumptive activity.
652 However, as with hunting, black bear viewing can have negative consequences for both
653 black bears and people if not managed appropriately. Black bears inhabiting areas popular
654 for black bear viewing have frequent benign encounters with people, which can cause
655 them to become habituated to human presence and show no overt reaction to people
656 (Penteriani et al. 2017). Habituated black bears are often a significant management
657 concern because they are at an increased risk of becoming food-conditioned, either

658 through being directly fed by people or by finding human food themselves (Hopkins et al.
659 2010). While food-conditioning is common both inside and outside of protected areas,
660 habituation is probably more common in parks and other areas where hunting (i.e., a form
661 of negative conditioning) is restricted (McCullough 1982).

662 **3.8 Black Bear Interactions with other Wildlife**

663 Black bear predation on neonate ungulates is a significant influence on ungulate
664 population dynamics in some areas of North America (Linnell et al. 1995, Bowyer et al.
665 1998, Zager and Beecham 2006). Within California, Monteith et al. (2014) found neonate
666 mule deer (*Odocoileus hemionus*) born west of the Sierra Crest, where black bear
667 densities are higher than east of the Sierra crest, were >6 times more likely to die of black
668 bear predation than any other cause. High rates of black bear predation were thought to
669 limit deer abundance in this area by causing a reduction in the proportion of deer that
670 migrate to summer range, as deer trade off obtaining superior nutritional benefits to avoid
671 predation (Monteith et al. 2014). Black bear predation is also a common cause of mortality
672 for black-tailed deer (*Odocoileus hemionus columbianus*) fawns in the Mendocino
673 National Forest (Wittmer et al. 2014).

674 Black bears are suspected of being a potential predator of desert tortoises (*Gopherus*
675 *agassizii*) (Lovich et al. 2014), which are listed as threatened under the California
676 Endangered Species Act. While even a single black bear could have negative effects on
677 small populations, such interactions are likely extremely rare because black bears and
678 desert tortoises have very different habitat preferences.

679 Within the Mendocino National Forest, black bears frequently displace mountain lions
680 from their kills, a behavior called kleptoparasitism. Elbroch et al. (2015) found black bears
681 at 77% of mountain lion kills, and black bears displaced mountain lions from them 72% of
682 the time. Black bear kleptoparasitism caused mountain lions to increase their kill rates
683 substantially to recoup energetic losses to black bears (Elbroch et al. 2015, Allen et al.
684 2021) and mountain lion ungulate kill rates in this system were the highest reported for the
685 species across their range (Allen et al. 2021, Cristescu et al. 2022). Collectively, high rates
686 of predation on fawns and kleptoparasitism of mountain lion kills by black bears have likely
687 contributed to a declining deer population in this area (Wittmer et al. 2014, Marescot et al.
688 2015).

689 Black bear interactions with wolves (*Canis lupus*) can be lethal or kleptoparasitic. Packs
690 are known to displace bears from carcasses or predate on bears themselves (Ballard et al.

691 2003). In areas without wolves, black bears may exhibit a release of predation and/or
692 competition (Frey et al. 2022), In California, these interactions are understudied, and
693 impacts on survival and prey selection are yet to be quantified.

694 More indirectly, black bears interact with other wildlife by dispersing seeds that they
695 consume. Black bears often swallow fruits whole, and the seeds remain intact once
696 excreted. Given their large home ranges, black bears can be even more effective than birds
697 in seed dispersal (Harrer and Levi 2018), and the movement of seeds contributes to the
698 maintenance of food and cover for many wildlife species. Some plant species even
699 germinate better after being digested and deposited in black bear scats than if they do not
700 go through this process (Rogers and Applegate 1983, Auger et al. 2002). Secondary seed
701 dispersers, such as small mammals, can become involved in multiple ways. Small
702 mammals can experience nutritional benefits by obtaining concentrated food sources.
703 Black bear scats can contain thousands of seeds containing enough energy to meet the
704 daily calorie requirements of >90 mice (Shakeri et al. 2018). Additionally, while long-
705 distance seed dispersal by black bears is important for plant propagation, some species
706 may not germinate well within scats because of high predation rates, competition, or an
707 inadequate temperature and moisture environment. Small mammals can disperse seeds a
708 second time from black bear scats and then bury them in safer locations, making the
709 combined effect of black bears and small mammals for seed dispersal greater than each
710 species would have alone (Enders and Vander Wall 2011).

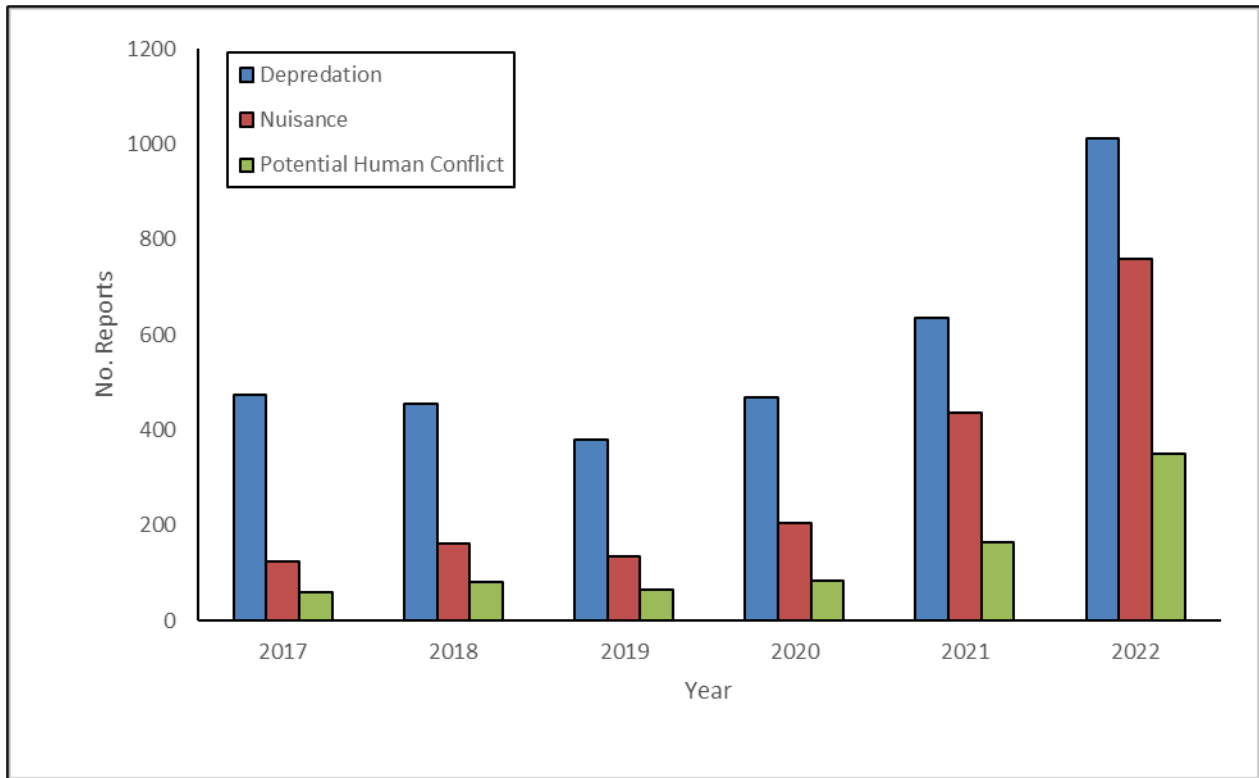
711 **3.9 Human-Black Bear Conflict**

712 With a population of almost 40 million people, conflicts between people and black bears
713 are common and management of these conflicts is a significant priority for CDFW. HBC
714 appears to have been increasing for decades due to increasing spatial overlap between
715 people and black bears (i.e., increased human development and recreation in black bear
716 habitat, expansion of black bear distribution). The vast majority of HBC involves the
717 intersection of black bears and attractants, such as food, garbage, and livestock.

718 Records of HBC are managed by CDFW staff. More standardized statewide recordkeeping
719 began in 2017, when a Wildlife Incident Reporting (WIR) system was created that both
720 CDFW staff and the public can submit reports to (Fig. 5).

721 During 2017-2022, excluding reports of black bear sightings in which no conflict occurred,
722 there were 6,049 HBC reports submitted through the WIR. In descending order of
723 frequency, reports were of depredation and property damage (57%), nuisance behavior

724 (30%), and potential human conflicts (13%). Reports of HBC were stable during 2017-2020,
725 averaging 674/yr, and then increased sharply by 160% during 2021 and 2022 to an average
726 of 1,678/yr. Hotspots of HBC reports included the Lake Tahoe Basin and the foothills of the
727 San Gabriel Mountains.



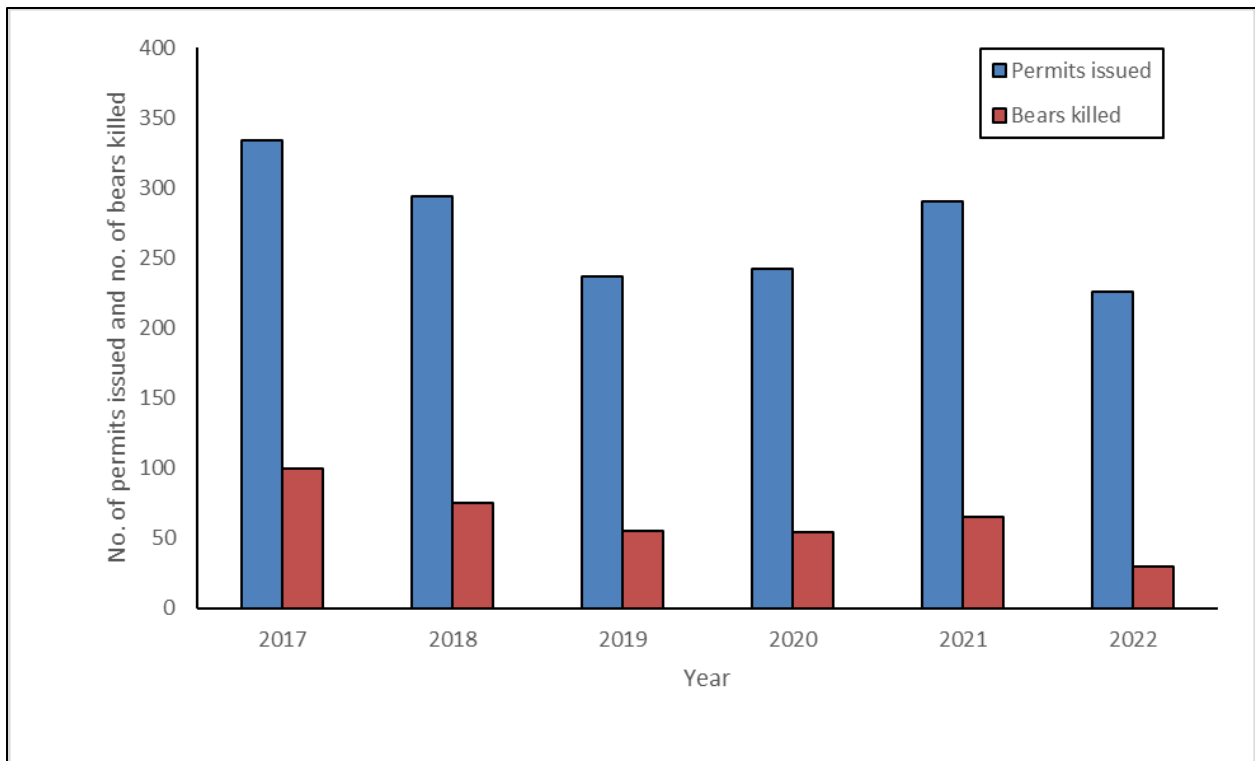
728
729 Figure 5. Number of human-black bear conflict reports submitted to the Wildlife Incident Reporting (WIR)
730 system (2017-2022).

731 While documenting the frequency, location, and severity of HBC is commonly used by
732 management agencies to track trends through time and evaluate the effectiveness of
733 management strategies, caution is warranted in interpreting the data. Trends in reports
734 may not accurately reflect actual trends in HBC. For example, the degree to which HBC
735 increases during 2021 and 2022 reflect an increase in HBC or an increase in reporting is
736 unclear, but it is likely that an increase in reporting was an important factor during 2022 at
737 least. In February of that year the CDFW began implementing Department Bulletin Number
738 2022-01 Black Bear Policy in California: Public Safety, Depredation, Conflict, and Animal
739 Welfare, which increased staff awareness of the WIR system by requiring its use for all
740 incidents requiring a response by CDFW.

741 Additionally, public reporting behavior can be biased in different ways. Howe et al. (2010)
742 thought that increases in HBC reports in Ontario, Canada were more likely the result of
743 public dissatisfaction with a controversial decision to end the spring black bear hunt,
744 rather than actual increases in HBC. Similarly, Wilbur et al. (2018) found that in Colorado,
745 the people most displeased with management had the highest HBC reporting rates. Other
746 factors that were predictive of a resident's decision to report HBCs included their prior
747 experience with black bears and attitudes related to tolerance of black bears. Recognizing
748 these potential biases is important because public attitudes are often geographically
749 clustered, meaning that spatial patterns of HBC reports may not reflect actual HBC (Wilbur
750 et al. 2018).

751 California is currently a member of BearWise (<https://bearwise.org/>), a program developed
752 and managed by biologists from multiple state natural resource agencies to provide
753 consistent information and messaging about coexisting with black bears. It promotes
754 education and preventative action as the most effective tools for reducing HBC.
755 Informational resources on black bear biology, behavior, and conflict prevention can be
756 found on the BearWise website.

757 CDFW staff provide assistance to landowners experiencing HBC in the form of education
758 and advice on corrective actions to prevent re-occurrence (e.g., hazing; eliminating
759 unnatural food or attractants by removing trash and bear-proofing food storage areas;
760 enclosing animal pens; installing fencing or electric fencing, motion lights and sprinklers,
761 noise machines, guard animals; or securing and blocking access to crawl spaces or other
762 potential denning sites). Depredation permits may also be issued (Fig. 6), typically after
763 other non-lethal management options have been exhausted in accordance with the black
764 bear policy.



765

766 Figure 6. Number of CDFW issued black bear depredation permits issued and numbers of black bears killed
 767 (2017-2022).

768 During 2017-2022, there was a declining trend in both the number of black bear
 769 depredation permits issued and the numbers of black bears killed under the permits. The
 770 number of black bears killed under depredation permits has decreased annually from 100
 771 in 2017 to 30 in 2022. Moreover, there has also been an annual increase in the percentage
 772 of permits issued that do not result in black bears being killed, from 70.1% in 2017 to
 773 86.7% in 2022. Though these trends may partly reflect changes in human attitudes toward
 774 black bears, there was also a significant policy shift in 2022 that is likely influencing recent
 775 patterns in depredation permit issuance and outcomes. CDFW's black bear policy (CDFW
 776 2022a) prioritizes non-lethal conflict mitigation measures before issuing permits for lethal
 777 take when possible. Permits for hazing bears have been issued, although these are still
 778 classified as depredation permits.

779 Key predictors of HBC include the availability of both natural foods and anthropogenic
 780 foods, proximity of black bear habitat to humans, and black bear abundance and density
 781 (Garshelis et al. 2020a). CDFW does not support diversionary feeding practices, and
 782 modifying the availability of natural foods is generally infeasible because periods of
 783 scarcity are driven by uncontrollable weather events such as drought, wildfires, late spring

784 frosts, etc. However, maintaining a diversity of habitat types through prescribed fire and
785 other silvicultural practices may be beneficial (Weaver 2000). Limiting future development
786 in black bear habitat is possible, but substantially reducing existing development is not.

787 Hunting black bears at a rate high enough to reduce their growth rates and abundance
788 across a large spatial scale can be effective for reducing HBC (Garshelis et al. 2020a). In
789 California, however, hunting levels over the past decade have been low (e.g., less than 3%
790 annually of the statewide population), and there is substantial public opposition to
791 increasing black bear harvest to a level that would be effective in controlling populations
792 (CDFW 2022b). Thus, encouraging the public to minimize black bear access to human
793 foods has been the primary tool used to manage HBC recently, in conjunction with non-
794 lethal methods designed to temporarily remove animals from conflict situations (e.g.,
795 hazing), and targeted lethal removal of individuals involved in conflicts by CDFW or through
796 the issuance of depredation permits. CDFW's black bear policy (CDFW 2022a) will govern
797 the CDFW response to HBC.

798 Reducing black bear access to human food can be effective for reducing HBC (Johnson et
799 al. 2018), but black bear resistant containers and associated infrastructure are often cost-
800 prohibitive for individuals and municipalities alike (McCarthy and Seavoy 1994). Even when
801 present, black bear resistant containers are often not used correctly (Lewis et al. 2015).
802 Therefore, planning and coordination at the local and state scales will be critical for
803 reducing HBC linked to anthropogenic food sources. Research from North America
804 suggests that availability of anthropogenic food sources may increase bear reproductive
805 and recruitment rates, thereby contributing to increased bear population density on the
806 wider landscape (McLean and Pelton 1990, Gould et al. 2021). Alternatively, there is also
807 evidence that low survival rates in urban environments due to HBC outweigh any increases
808 in fecundity and lead to an “ecological trap” in which wildland bears disperse into urban
809 environments and reduce overall bear density through source-sink dynamics (Beckmann
810 and Lackey 2008, Baruch-Mordo et al. 2014). This information suggests that reducing
811 access to anthropogenic food sources may reduce both HBC and local black bear
812 densities by reducing either recruitment or immigration rates.

813 Black bears can have large home ranges and often travel long distances to locate seasonal
814 food sources. Consequently, they frequently cross roads where they are susceptible to
815 vehicle collisions. An average of 111 black bears were reported killed on California roads
816 annually during 2016-2020 (University of California 2021). While reporting rates of black
817 bear-vehicle collisions are probably higher than they are for species that are more
818 commonly killed on roads, such as birds and small mammals (Paul et al. 2014) and black

819 bear carcasses are more likely to be detected by highway workers, it is unknown how these
820 incidental reports compare to the true number of black bears killed, which is likely higher,
821 as there is no formal reporting structure to document black bear-vehicle collisions. In
822 addition, age and sex information are not collected from road-killed black bears, which
823 further limits the ability of these data for informing the impacts of vehicle collisions on
824 black bear populations. At a population-level scale, vehicle collisions have not been
825 reported to be influential in population dynamics, but at local scales vehicle collisions can
826 have pronounced effects (Brandenburg 1995, Laufenberg et al. 2018).

827 While further study of the impacts that vehicle collisions have on black bear populations
828 may be warranted, black bear-vehicle collisions are a management concern nonetheless
829 for several reasons. First, they pose a substantial safety risk to people. Between 4-10% of
830 vehicle collisions with large mammals result in human injury (US Department of
831 Transportation 2008). Second, they are financially costly. The average cost of a collision
832 with a deer, including vehicle repair, medical bills, towing and law enforcement, monetary
833 value of the animal and carcass disposal is estimated at \$6,700 (US Department of
834 Transportation 2008). Finally, black bear-vehicle collisions generate concern about animal
835 welfare (see Section 5.4), particularly when cubs become orphaned or when animals
836 experience prolonged suffering prior to death or severe injury without death.

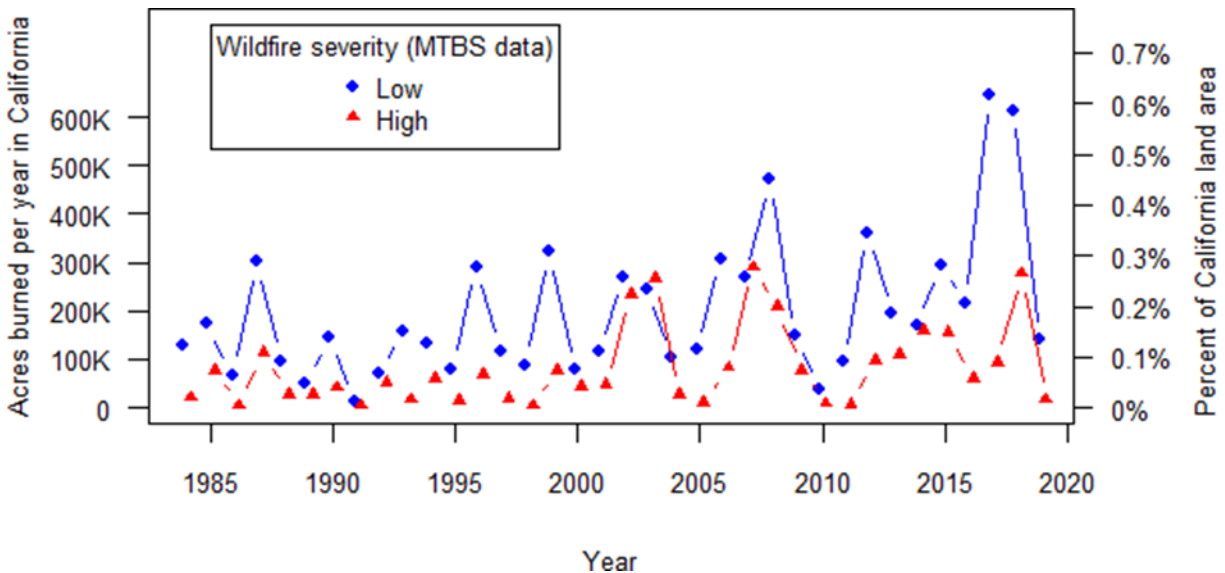
837 **3.10 Climate Change, Wildfire, Drought, and Land Use**

838 The global climate is changing at a faster pace than previously anticipated (Smith et al.
839 2015, Xu et al. 2018) and scientists expect cumulatively deleterious impacts to wildlife
840 (Pimm et al. 2014, Ceballos et al. 2017, Spooner et al. 2018). In California, climate change
841 is expected to 1) alter vegetation composition of wildlife habitats forcing species to either
842 shift their geographical ranges or otherwise adapt, 2) increase wildfire extent and severity,
843 3) increase variation in precipitation leading to both extended droughts and periods of
844 severe flooding, 4) create phenological mismatches between wildlife species and their
845 habitat and foraging resources, and 5) exacerbate land use impacts and other
846 anthropogenic stressors on biodiversity (Parmesan 2007, Mann and Gleick 2015, Williams
847 et al. 2019, Huang and Swain 2022).

848 Wildfires and droughts can impact black bear habitat by altering vegetation structure
849 and/or composition, which black bears rely on for cover, denning, and food. In the short-
850 term following wildfires, black bears may continue to use all areas of a burn, even those
851 burned with high severity (Crabb et al. 2022). Conversely, black bears may avoid burned
852 areas until vegetation recovery occurs (Bard and Cain 2020), and reduced food availability

853 may result in low cub recruitment (Cunningham and Ballard 2004). Either way, wildfires
854 with substantial areas of high burn severity have not been found to be catastrophic for
855 black bears (Crabb et al. 2022, Koel et al. 2019). In the long term, wildfires generally have
856 positive effects and mosaics of burn ages and intensities produce diverse habitat
857 conditions that provide black bears with necessary cover and forage resources (Young and
858 Beecham 1986, Stratman and Pelton 2007, Crabb et al. 2022).

859 In particular, low severity fire can diversify food resources for omnivorous mammals such
860 as black bears and thereby possibly mitigate HBC (Weaver 2000, Crabb et al. 2022). These
861 fires can also create logs and other structural features for denning while maintaining forest
862 cover. Overall, research from California shows that low severity burning at an average
863 annual rate of 2% across forested landscapes benefits black bears and other carnivore
864 species (Furnas et al. 2022). The current rate of low severity fire is much lower than this
865 threshold, and it is also lower compared to the mixed severity fire regime that shaped the
866 structure and heterogeneity of California forest over millennia prior to climate change, fire
867 suppression and other anthropogenic impacts (Taylor and Skinner 2003, Millar et al. 2007).
868 Nonetheless, even in an era of increasing megafires, there is still more low severity than
869 high severity fire in California forests (Fig. 7). As demonstrated by California Native
870 American Tribes and others, prescribed burning can be an effective management tool and
871 surrogate for naturally occurring wildfire that benefits black bears and other wildlife
872 (Connor et al. 2022, Furnas et al. 2022).



873
874 Figure 7. Low and high burn severity amounts in California through time based on analysis of the Monitoring
875 Trends in Burn Severity database (MTBS, methods described in Eidenshink et al. 2007).

876 Climate change in conjunction with the availability of human food sources is expected to
877 reduce the average duration of bear hibernation thereby extending the active bear season
878 and potentially exacerbating HBC in some places (Johnson et al. 2017). In systems with
879 little human development, natural food shortages, often associated with droughts, may
880 cause declines in reproduction (Rogers 1976, Elowe and Dodge 1989) but generally do not
881 impact adult survival (Kasbohm et al. 1996, Clark et al. 2005). In these circumstances,
882 food shortages have limited effects on black bear populations (Laufenberg et al. 2018). In
883 developed areas however, natural food shortages may induce black bears to shift their
884 foraging to human foods, increasing their exposure to human-caused mortality (Baruch-
885 Mordo et al. 2014, Laufenberg et al. 2018). For one black bear population near Durango,
886 Colorado, a natural food shortage was associated with the most severe black bear
887 population decline ever documented over a 1-year period, which was suspected to be the
888 result of much higher-than-normal human-caused mortality rates, primarily vehicle
889 collisions (Laufenberg et al. 2018). Although black bear populations are likely to be
890 resilient to climate change due to their remarkable adaptability to changing environmental
891 conditions (Garshelis et al. 2020b), they may face declines due to interactions between
892 climate change and forest management -induced food shortages and anthropogenic
893 pressures (Baruch-Mordo et al. 2014, Laufenberg et al. 2018, Rettler et al. 2021).

894 **3.11 Tribal Authority and Perspectives**

895 Since time immemorial California has been home to a great diversity of Native American
896 Tribes. Although these Tribes vary considerably in terms of language and culture, they
897 share a strong ecological, cultural, and spiritual connection to the land (Rawls 1984). This
898 includes a long history of using fire and other tools to manage habitats for the plant and
899 wildlife resources which supported Tribal peoples in California (Anderson 2005).

900 European settlement of California severely impacted Tribal populations, their cultures and
901 livelihoods, and their tenure over the land (Rawls 1984, Starr 2005). Yet, approximately 180
902 distinct Tribes remain active in the state today. Many are providing leadership in wildlife
903 science, conservation, and management (Matthews et al. 2008, Ramos 2022, Connor et al.
904 2022). This includes a Tribal management plan for black bears (Higley et al. 2006). Black
905 bears are an especially important animal to many California Tribes to which many people
906 ascribe kinship. For example, an annual ceremonial “bear dance” honoring this bond is
907 still practiced by some Tribes. Based on comments provided at the listening sessions
908 described below, the names for black bear in various California Tribal languages include
909 *Virusur*, *Cher'ere*, *Wah'ima*, and *Sa:ts'* among many others.

910 In Executive Order B-10-11 and reaffirmed in Executive Order N-15-19, the State of
911 California recognizes the sovereign authority of California Tribes over their ancestral
912 territories and activities. Additional actions by the California Natural Resources Agency
913 (CNRA) to integrate the historical knowledge of Tribes support efforts to further incorporate
914 tribal perspectives in scientific and policy discussions. Further, it is the policy of CDFW to
915 notify, consult, and promote collaboration and co-management with Tribes on proposed
916 activities affecting black bears and other wildlife species (CDFW 2014). In June 2022, the
917 CDFW notified all California Tribes of our intention to revise this black bear conservation
918 plan and requested their input via consultation. After further notification, two online
919 listening sessions were held with Tribes in May 2023. In total, the CDFW received and
920 heard comments, interests, and views pertaining to black bears from eight Tribes including
921 the Barbareno/Ventureno Band of Mission Indians, the Hoopa Tribe, the Karuk Tribe, the
922 Morongo Band of Mission Indians, the Pit River Tribe, the Resighini Rancheria, the Rincon
923 Band of Luiseño Indians, and the Yurok Tribe, which are summarize below (Table 1).

-
1. California Native American Tribes are diverse, representing a variety of perspectives with respect to black bear conservation and management, however, overall black bears and humans are viewed as intrinsically connected spiritually, culturally, and ecologically.
 2. Tribes expressed concerns about the ecological health of habitats supporting black bears and other species and provided recommendations for using prescribed fire to restore those habitats.
 3. Tribes expressed concerns about the need for improved human infrastructure for enabling successful non-lethal responses to human-black bear conflict. This included discussion of the affordability and availability of secure garbage containers.
 4. Tribes noted the need for clarifying the applicability of Tribal ordinances to non-Tribal persons who hunt on Tribal lands.
 5. Tribes noted a desire to streamline a process facilitating Tribes to recover black bears that are killed in collisions with vehicles. This included discussion that black bears are important culturally and spiritually to many California Tribes.
 6. There is a diversity of views among Tribes pertaining to the ethics of black bear hunting, but sport and subsistence hunting of black bears is not common among California Tribes. There is greater (but not widespread) support for killing black bears, in some circumstances, as part of management to mitigate human-black bear conflict.
 7. One Tribe expressed concern about bear hunting in southern California mountain ranges that overlap their ancestral territories. They requested that CDFW prohibit hunting in any areas where population density is low.
 8. There is interest in combining CDFW wildlife research activities with Tribal youth environmental education programs.
 9. There is also interest in increased collaboration and co-management regarding conservation and management of black bears and other wildlife species. This included discussion about the value of supporting, sustaining, and expanding the capacity of Tribal wildlife research and management departments, and developing agreements for data sharing. It also included discussion of interest in developing approaches for increasing opportunities for Tribal hunting and subsistence use of game species, but this interest was focused on species other than black bears.
-

925 **3.12 Rulemaking Process**

926 The California State Legislature has delegated a variety of powers to the Fish and Game
927 Commission (“Commission”). These powers are delegated within California Statutes that
928 comprise Fish and Game Code (FGC). The FGC establishes the basis of fish, wildlife, and
929 native plant management and protection in California, and can only be established and
930 modified by the State Legislature. The FGC more specifically establishes the
931 Commission’s authority in fish and wildlife rules, regulations, and policy making, whereas
932 CDFW is designated as the trustee for fish and wildlife resources. CDFW is charged with
933 implementing and enforcing regulations set forth by the Commission, as well as providing
934 biological data and expertise to inform the Commission’s decision-making process. Under
935 administrative law, the California Code of Regulations (CCR) codifies general and
936 permanent rules and regulations to be enacted by the agency responsible for
937 implementation. The Commission and CDFW work within CCR Title 14- Natural Resources.
938 Regulations routinely addressed under Title 14 include general harvest regulations
939 including harvest quota, season dates, and hunt zone boundaries. Management features
940 can be adopted, amended, or repealed via the Administrative Procedures Act (APA)
941 rulemaking process. The APA is a requirement by law that allows for the public to
942 participate in the adoption of state regulations to ensure that the regulations proposed are
943 clear, necessary, and legally valid.

944 CDFW provides recommendations for adopting, amending, or repealing regulations based
945 on inventory and monitoring of resources, as well as both biological and social conditions.
946 To change hunting regulations for any species, an additional parallel document is required
947 through the California Environmental Quality Act (CEQA). CEQA requires all public
948 agencies to evaluate the environmental impacts of projects, including regulation changes
949 which may have potential to significantly affect the environment. CDFW has prepared
950 Environmental Documents for each harvested species, including black bear, on behalf of
951 the Commission. This document serves as a guide for periodic harvest adjustment
952 recommendations within the APA process.

953 The APA process for enacting new Title 14 regulations generally requires a 12-18 month
954 timeline composed of several public meetings (Table 2). The process generally begins with
955 2 initial discussion meetings at public meetings of the Wildlife Resources Committee
956 (WRC) which is chaired by one member of the Commission. An initial scoping meeting of
957 the WRC is typically held in May to discuss general rulemaking needs and is followed by a
958 recommendation meeting of the WRC in September to approve or reject moving the
959 rulemaking under consideration forward to present to the Commission. If a rulemaking is

960 approved to move forward by the WRC, the proposed regulation change is presented to the
 961 Commission at a public notice hearing in December. A public comment period follows this
 962 meeting. In February, a public discussion hearing is held, where the details of the proposed
 963 changes are discussed by the Commission and the general public and comments are
 964 responded to by CDFW staff. Adoption hearings would then be held in April, where final
 965 recommendations are presented by CDFW staff – formed in part by public comments and
 966 inquiry and discussion with the Commission. The regulatory framework is a public process
 967 that provides multiple opportunities for the public to engage with the Commission and
 968 CDFW to manage our shared resources effectively. The Commission has final approval
 969 authority to adopt, amend, repeal, or reject proposals set forth by CDFW or the general
 970 public. If a new regulation is approved, CDFW is responsible for implementation.
 971 Generally, this occurs in the fall when hunting seasons open.

972 Table 2. Administrative process and general timeline for adopting Title 14 regulations affecting black bear
 973 hunting and conservation.

Action	Government authority	Timeframe
Initial scoping	Wildlife Resources	May, year 1
Recommendation to proceed	Wildlife Resources	September, year 1
Notice hearing	Fish and Game Commission	December, year 1
Public discussion	Fish and Game Commission	February, year 2
Adoption vote	Fish and Game Commission	April, year 2
Implementation	CDFW	June-November, year 2

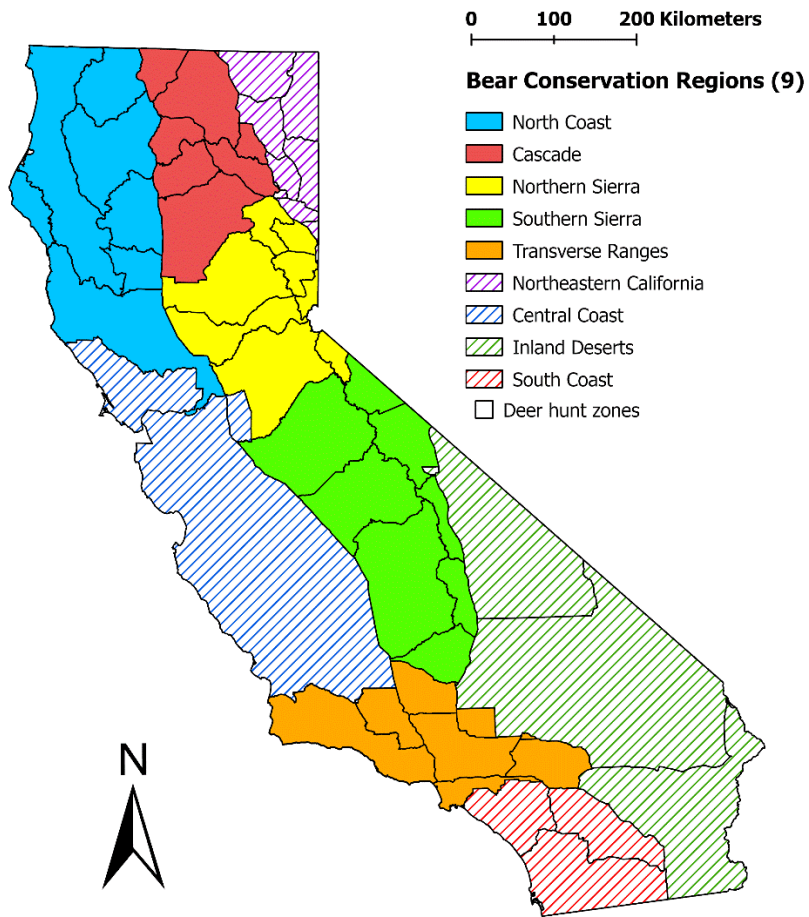
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975 **Chapter 4. Population Monitoring**

976 **4.1 Black Bear Conservation Regions**

977 Due to California’s geographical size and ecological diversity, black bear populations
978 throughout the state may differ in terms of abundance, genetic diversity, and disease
979 vulnerability. Therefore, the California Department of Fish and Wildlife (CDFW) intends to
980 monitor black bear populations separately within nine Bear Conservation Regions (BCRs)
981 representative of these potential differences.

982 Black bear hunting generally runs concurrent with the deer hunting seasons, and the area
983 open to black bear hunting is largely delineated by deer hunt zones. For these reasons
984 CDFW is adopting BCRs conforming to groups of deer zones (Fig. 8). These BCRs also
985 generally conform to different ecological regions and CDFW administrative regions.



986

987 Figure 8. Bear Conservation Regions (BCRs) within which population trends would be monitored and harvest
 988 limits set. Solid patterns represent BCRs where hunting currently occurs, and dashed patterns represent
 989 BCRs where there is currently no hunting.

990 The 56,931-km² **North Coast** BCR lies mostly in CDFW Region 1, overlaps the
 991 Northern California Coastal Ranges and Klamath Mountains ecoregions, and
 992 includes deer zones B1—B6, and portions of the A North Unit.

993 The 29,640-km² **Cascade** BCR lies mostly in CDFW Region 1, overlaps the Southern
 994 Cascades ecoregion, and includes deer zones C1—C4, X1, X4, and portions of X3a.

995 The 34,463-km² **Northern Sierra** BCR lies mostly in CDFW Region 2, overlaps the
 996 Sierra Nevada ecoregion, and includes deer zones D3—D5, X7a, X7b, X8, and
 997 portions of X6a and X6b.

998 The 53,437-km² **Southern Sierra** BCR lies mostly in CDFW Regions 4 and 6,
999 overlaps the Sierra Nevada ecoregion, and includes deer zones D6—D9, X9a, X9b,
1000 X10, and X12.

1001 The 32,046-km² **Transverse Ranges** BCR lies mostly in CDFW Regions 5 and 6,
1002 overlaps the Transverse Ranges ecoregion, and includes deer zones D10, D11, D13,
1003 D14, and portions of D15, D17, and the A South Unit.

1004 The 16,165-km² **Northeastern California** BCR lies entirely in CDFW Region 1,
1005 overlaps the Modoc Plateau ecoregion, and includes deer zones X2, portions of X3a,
1006 X3b, portions of X4, X5a, X5b, and portions of X6a and X6b.

1007 The 68,284-km² **Central Coast** BCR lies mostly in CDFW Regions 3 and 4, overlaps
1008 the Central California Coast and Great Valley ecoregions, and includes portions of
1009 the A North Unit and A South Unit.

1010 The 93,355-km² **Inland Deserts** BCR lies mostly in CDFW Region 6, overlaps the
1011 Mojave Desert and Sonoran Desert ecoregions, and includes deer zones D12, D17,
1012 and X9c.

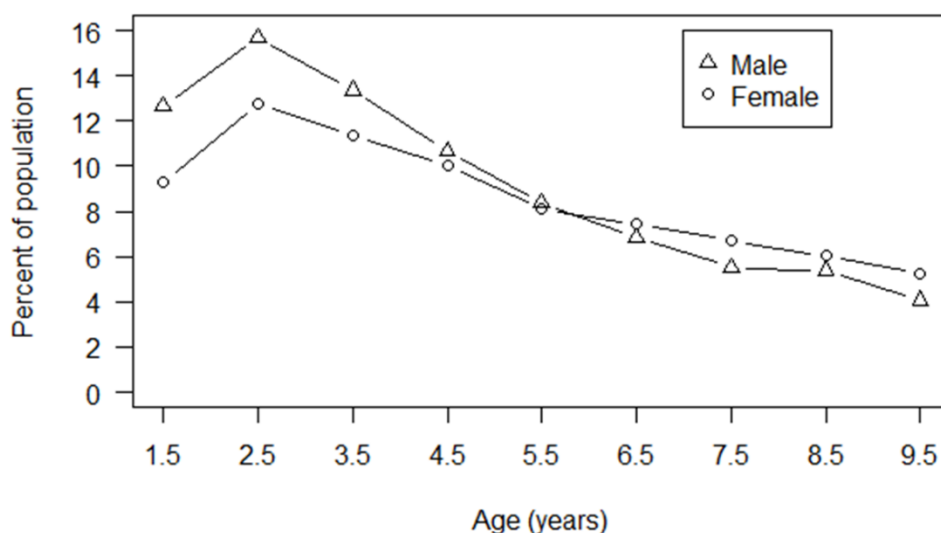
1013 The 24,746-km² **South Coast** BCR lies in CDFW Regions 5 and 6, overlaps the
1014 Southern California Coast and Southern California Mountains and Valleys
1015 ecoregions, and includes deer zones D16 and D19 and portions of D15.

1016 Although CDFW will be monitoring black bear populations at the BCR scale, regulatory
1017 changes (Title 14 CCR) approved by the Fish and Game Commission would be required to
1018 modify the statewide annual harvest limit (e.g., currently 1,700 black bears) so that
1019 separate limits apply within each BCR. CDFW will also monitor bear populations in
1020 unhunted areas to inform conservation in these areas and to understand any potential
1021 range expansion.

1022 **4.2 Integrated Population Model**

1023 Black bear age and sex structure (i.e., percent of black bears by each year of age for each
1024 sex, Fig. 9) is a key source of data that CDFW uses to monitor black bear populations in
1025 California. CDFW can use this information to evaluate the effects of hunting and other
1026 factors on the statewide black bear population. For over two decades, hunters have
1027 provided tooth samples from harvested black bears. CDFW sends these teeth to a
1028 laboratory that counts annual rings visible in each tooth to determine the age of each

1029 harvested bear. For many years, CDFW used these data in a mathematical model that
1030 estimated the total statewide black bear population size each year by comparing the age
1031 structures of males and females to the total number of harvested black bears (Fraser
1032 1976). As males are more frequently harvested than females, there is a greater proportion
1033 of them in the younger age classes of harvested bears. This effect dissipates with older
1034 bears, so the sex ratio approaches 1:1 at a given age (Fig. 9). The age at which this occurs
1035 was then used as a parameter for estimating the total population size. However, a key
1036 accuracy assumption of the model was violated when hunter effort and success changed
1037 in 2013, when the use of dogs to hunt black bears was discontinued (Harris and Metzgar
1038 1987, CDFW 2022b).

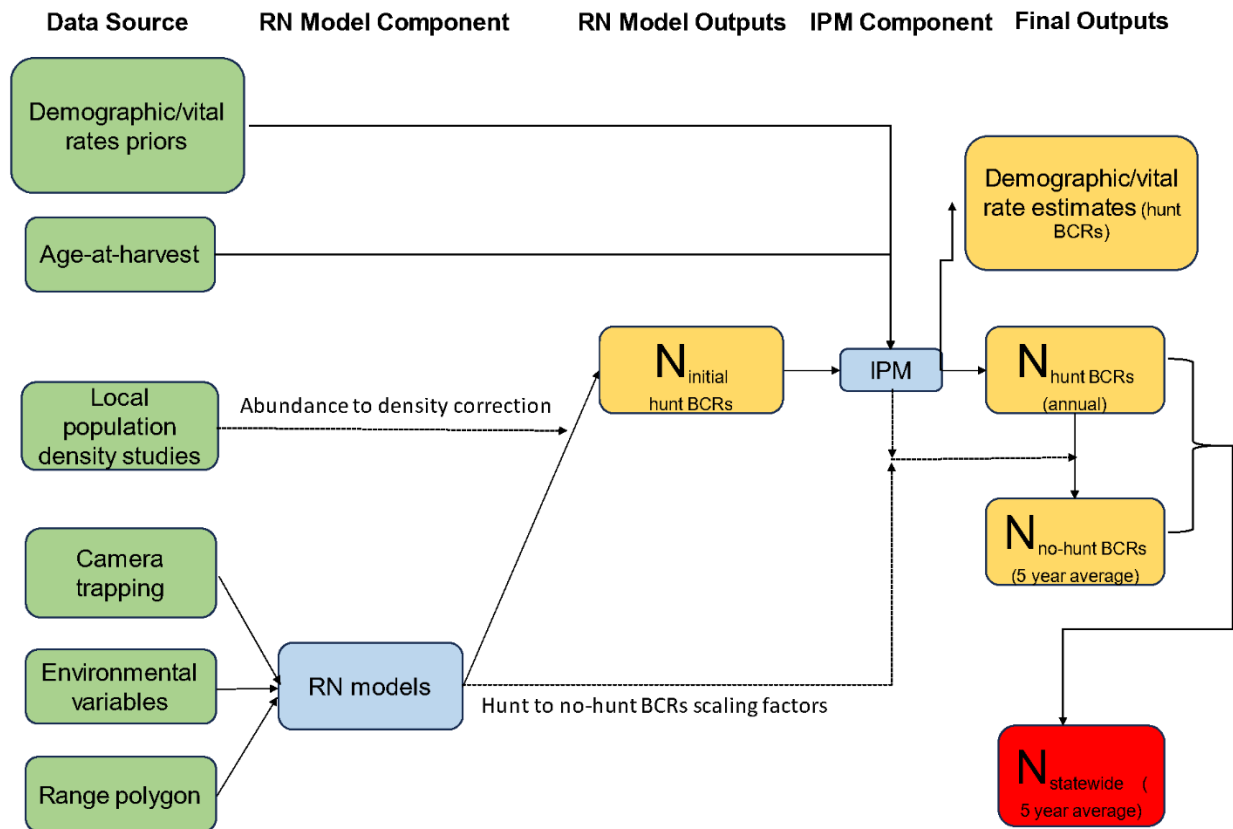


1039
1040 Figure 9. An example of age structure data for black bears in California. Hunters provide a tooth from each
1041 harvested bear ($n \sim 1,300$ each year) from which the age can be estimated by a laboratory.

1042 Integrated population models (IPM) are a powerful tool to efficiently combine different
1043 types of available information (e.g., population surveys, age and sex structure, survival,
1044 and reproductive rates) to better monitor population sizes and trends and understand the
1045 drivers of trends (Arnold et al. 2018, Zipkin and Saunders 2018). Recent advances in
1046 computing speed and Bayesian algorithms to solve complex problems have led to the
1047 increased application of IPMs and other types of advanced hierarchical models in wildlife
1048 ecology (Schaub and Kery 2012, Kery and Royle 2021). In particular, Bayesian models
1049 facilitate incorporating multiple sources of data including through the use of “informative
1050 priors”. Put in other words, final estimates combine inferences from the data being
1051 modeled and prior information from other studies. In 2022, CDFW began the process of
1052 adapting a black bear IPM originally developed in Wisconsin for use in California (Allen et

1053 al. 2018a). The new IPM for California black bears combines the age and sex structure
1054 information from tooth sampling with additional information on vital rates (e.g.,
1055 reproduction and survival) and other factors (e.g., non-reporting rate for hunter harvest).
1056 For the time being, most of the information included in the IPM on vital rates comes from
1057 published studies throughout North America. It includes some California information on
1058 hunting season adult survival which is expected to be higher in California than in
1059 Wisconsin where the bear IPM was first applied. The California black bear IPM also
1060 includes local information on the harvest non-reporting rate based on available data for
1061 deer. CDFW does not currently have the non-reporting rate for black bears but will be
1062 prioritizing the collection of that data. In the meantime, CDFW is using the deer non-
1063 reporting rate due to the substantial overlap between California's deer and black bear
1064 hunters.

1065 CDFW also used information from local black bear density studies and species distribution
1066 modeling from camera traps to calculate informative priors on the initial value of black
1067 bear population size in each BCR (Figure 10). The IPM then applies an algorithm called
1068 Markov chain Monte Carlo (MCMC) to compute statistical probabilities which it uses to
1069 estimate the most likely final values (i.e., posterior distributions) of the population sizes
1070 and other model parameters, given the totality of information considered in the model. To
1071 get these priors, CDFW used a special type of occupancy model (Royle and Nichols 2003)
1072 to estimate how relative abundance varies spatially with covariates (e.g., elevation and
1073 forest cover) across the state at thousands of camera trap locations. CDFW then
1074 calibrated the camera modeling against black bear densities independently estimated
1075 from eight local studies that used various methods ranging from counts of GPS collared
1076 bears to spatial capture-recapture modeling (Kelleyhouse 1977, Piekielek and Burton
1077 1975, Matthews et al. 2008, Fusaro et al. 2017, Owen-Ramos et al. 2022, CDFW
1078 unpublished data).



1079

1080 Figure 10. A flowchart showing the components and framework of the IPM. Solid lines indicate a direct input
 1081 or output. Dashed lines indicate modifying or scaling effects. RN refers to the Royle-Nichols occupancy
 1082 models that are used to predict black bear abundance using camera trap data. IPM refers to the integrated
 1083 population model which estimates black bear population size and structure. N refers to population size.

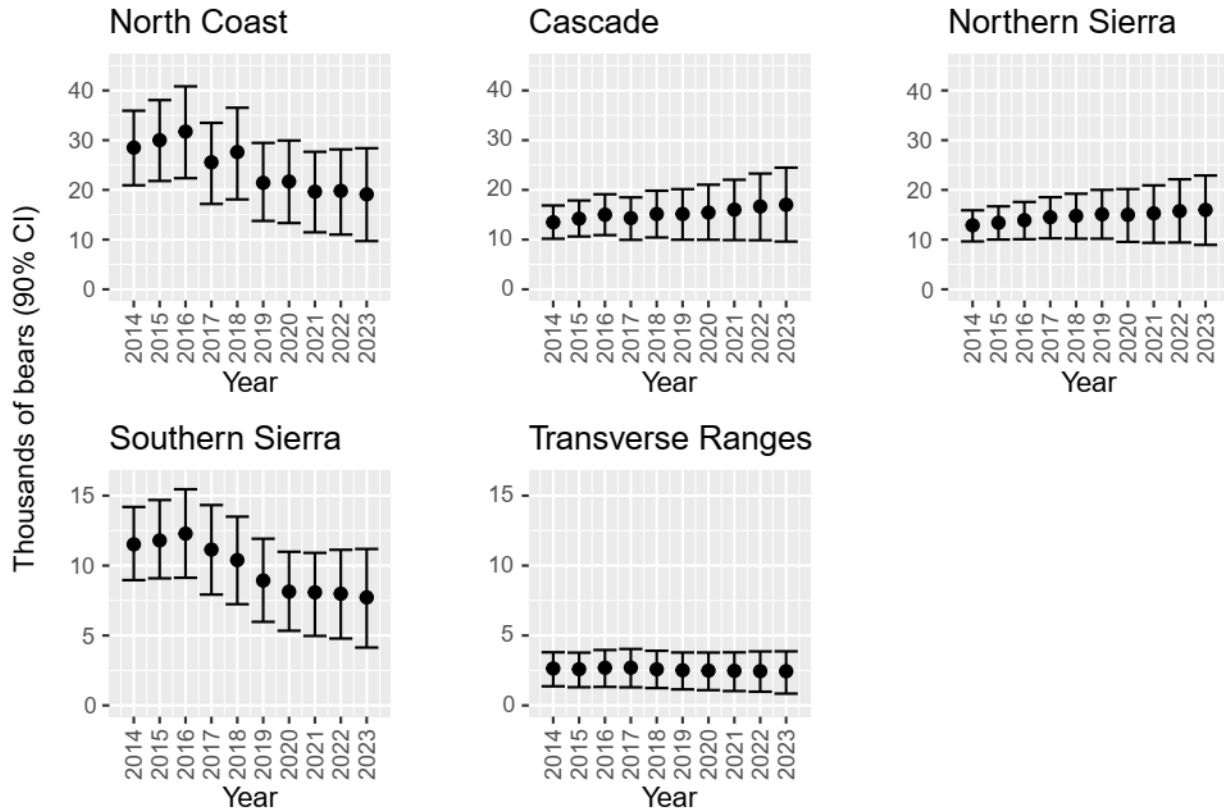
1084 Using the IPM with currently available data, CDFW estimates a total statewide black bear
 1085 population (5-year average, 2019–2023) of 65,405 (90%CI: 49,549–80,935, Table 3). It is
 1086 expected that the accuracy and precision of population estimates will improve further as
 1087 CDFW begins to regularly collect local information on vital rates. Nevertheless, CDFW
 1088 considers the current estimate reliable because it is based on multiple sources of
 1089 information and a modeling framework that has been shown to be robust to inaccuracies
 1090 about vital rates (Allen et al. 2018a).

1091 Table 3. Current best estimates of black bear population size for all of California and Bear Conservation
 1092 Regions within the state. The estimates below represent a 5-year average for 2019-2023.

Bear Conservation Region	Population estimate (90% CI)	Hunter harvest	Harvest rate
Hunt:			
North Coast	20,335 (12,221–28,627)	447	1.6%–3.7%
Cascade	16,059 (9,897–22,031)	217	1.0%–2.2%
Northern Sierra	15,420 (9,473–21,038)	279	1.3%–2.9%
Southern Sierra	8,173 (5,116–11,115)	259	2.3%–5.1%
Transverse Ranges	2,473 (1,024–3,793)	61	1.6%–6.0%
No-hunt*:			
Northeastern California	1,308 (802–1,812)	N/A	N/A
Central Coast	942 (501–1,373)	N/A	N/A
Inland Deserts	143 (83–201)	N/A	N/A
South Coast	551 (218–885)	N/A	N/A
Statewide	65,405 (49,549–80,935)	1,262	1.6%–2.5%

1093 *Population estimates in no-hunt Bear Conservation Regions are currently based on spatial predictions from
 1094 the camera trap-based Royle-Nichols occupancy model (Royle and Nichols 2003) scaled to results from an
 1095 age-at-harvest (AAH)-based integrated population model (IPM). Thus, estimates in no-hunt BCRs should be
 1096 interpreted cautiously.

1097 The IPM also provides strong evidence that black bear populations have been stable in all
 1098 BCRs over the past decade (Fig. 10). There is no evidence of any statistically credible
 1099 ($P > 0.1$) population declines or increases at the BCR scale during 2014-2023. One caveat is
 1100 that the current modeling approach allows CDFW to extrapolate black bear population size
 1101 in the no-hunt BCRs using occupancy modeling of camera trap surveys, but the lack of age
 1102 distribution data outside of hunted regions currently precludes evaluation of population
 1103 trend in the no-hunt BCRs. This issue could be rectified through the analysis of additional
 1104 camera trap data and expansion of the age distribution and vital rates monitoring from
 1105 areas where no hunting currently occurs.

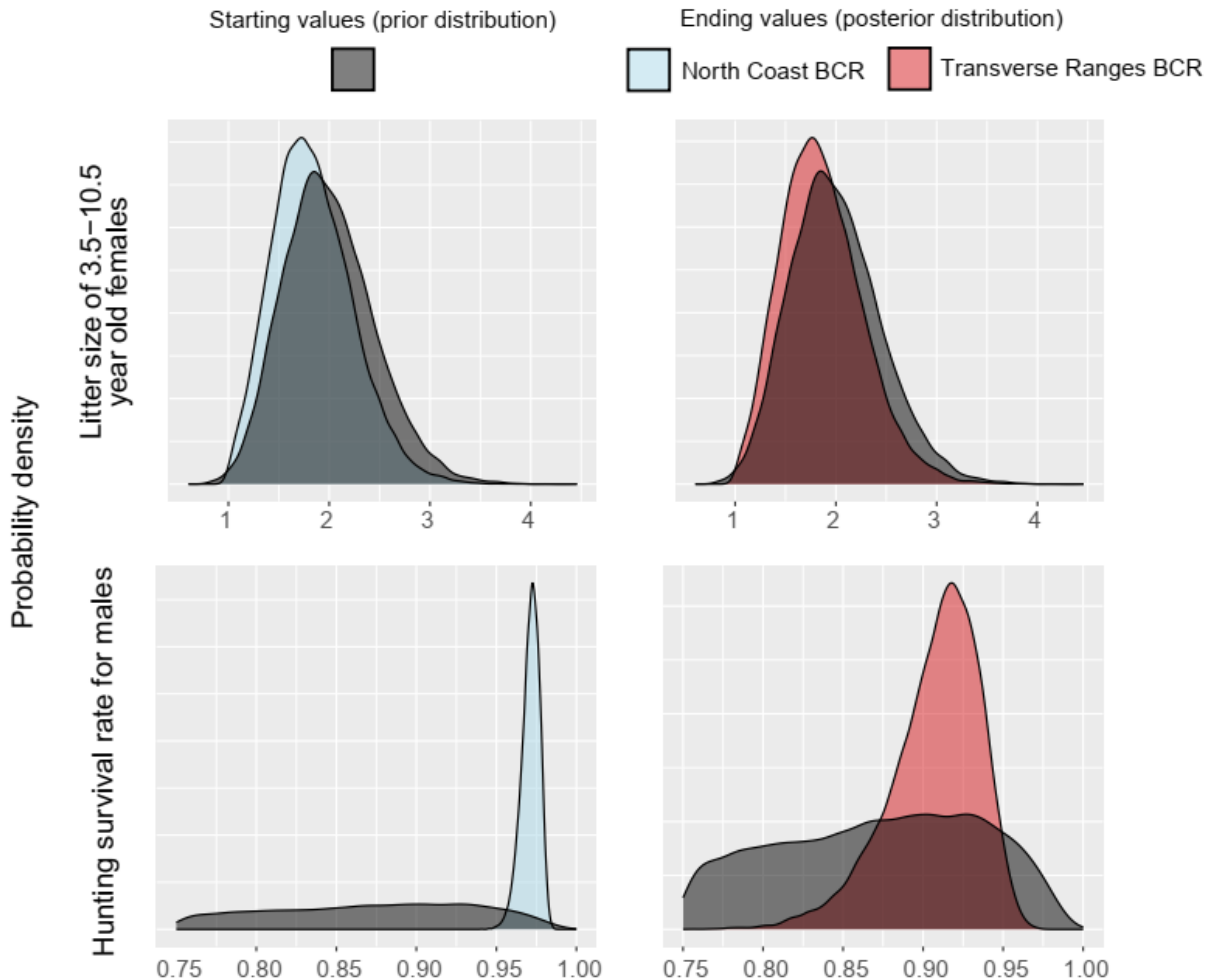


1106

1107 Figure 11. Evidence of lack of significant population trends in all California Bear Conservation Regions (BCRs)
 1108 where hunting occurs based on the integrated population model (IPM).

1109 Based on the age distributions and other sources of data included in the IPM, the model is
 1110 estimating a hunting season survival rate that is higher and more precise than the prior
 1111 information CDFW included in the modeling (Fig. 11). The updated posterior estimate
 1112 makes sense considering that there is less hunting pressure in California than in other
 1113 regions of North America. The current modeling approach, however, highlights the need for
 1114 10–15 local study areas throughout California to monitor black bear vital rates and other
 1115 information, to complement the age and sex structure data used in the IPM. The locations
 1116 of these study areas should be chosen to represent the range of black bear habitats across
 1117 California and within BCRs. Vital rates within study areas could be monitored through a
 1118 combination of GPS telemetry collars, den checks, camera grids, hair snares, fecal DNA,
 1119 and other methods. Reproductive rates could also be estimated outside of these study
 1120 areas using the thousands of camera traps surveyed in California each year, through
 1121 analyzing how the number of cubs per adult female photographed changes each month.
 1122 Additionally, CDFW will explore options for gathering information about pregnancy status
 1123 inferred from the same tooth samples used to estimate ages of harvested bears. Thinner

1124 tooth cementum annuli rings are often a signal of pregnancy in female bears, but
1125 methodological uncertainties will need to be formally addressed if the data are included in
1126 the IPM (Allen et al. 2017).



1127

1128 Figure 12. Plots of the prior and estimated posterior distributions of two key vital rates in the IPM for the year
1129 2016 and in the North Coast and Transverse Ranges Bear Conservation Regions (BCRs). The plot of the
1130 predicted litter size of females aged 3.5-10.5 shows minimal departure from the informed prior distribution.
1131 The plot of estimated hunting survival rates for males shows a relatively high predicted survival rate in both
1132 BCRs and a large departure from the informed prior distribution, though lower rates in the Transverse Ranges
1133 compared to the North Coast.

1134 Another source of potential bias in the IPM is that the age structure data are based on the
1135 ages of harvested black bears. While the age structure of harvested bears may not be fully
1136 representative of the age structure in the total population, the IPM can account for
1137 different harvest rates faced by different sex and age classes by estimating age, sex, and

1138 year-specific hunting season survival rates (Allen et al. 2018a). Following the
1139 recommendations of Allen et al. (2018b), CDFW made additional adjustments to priors
1140 included in the IPM to offset the effects of expected age distribution bias in the black bear
1141 harvest. Additionally, CDFW will develop independent methods to sample the ages of non-
1142 harvested black bears. CDFW will compare the age distributions of harvested and non-
1143 harvested black bears, and use this comparison to adjust the IPM, if necessary (e.g.,
1144 double sampling, Cochran 1977). CDFW expects that this adjustment would require a
1145 substantially smaller sample of non-hunted black bears with respect to the large amount
1146 of age data provided by hunters.

1147 Spatial capture-recapture (SCR) modeling using field collection of genetic samples is a
1148 powerful method for robustly estimating bear abundance (Royle et al. 2013). CDFW does
1149 not need to rely on this method for black bears as much as for other species (Furnas et al.
1150 2018), because of the age distribution data available for both sexes used in the IPM. CDFW
1151 did use SCR from local genetic studies (e.g., Owen-Ramos et al. 2022) for providing prior
1152 information on bear densities used in the IPM. To improve precision and accuracy of the
1153 IPM, CDFW will periodically conduct additional genetic surveys among the 10-15 local
1154 study areas for updating local densities used as priors in the IPM.

1155 CDFW will develop a black bear population monitoring plan following completion of this
1156 conservation plan. It will provide greater detail on the data inputs and structure of the IPM,
1157 and protocols, timelines, and logistics for collecting all the necessary data statewide and
1158 within local study areas. This will be crucial to make sure appropriate data are being
1159 collected for use in the IPM.

1160 **4.3 Other Population Indicators and Harvest Metrics**

1161 Monitoring how black bear population size varies by BCR and year (i.e., using the IPM) is
1162 the primary scientific information CDFW needs to conserve the species throughout the
1163 state and ensure regulated hunting is sustainable. Vital rates (e.g., recruitment and
1164 survival) are key inputs into the IPM which will also provide CDFW with the ability to better
1165 understand the potential causes of any population trend. Some of the methods to estimate
1166 vital rates will involve deploying GPS collars on adult black bears, using GPS data to locate
1167 and monitor dens, and using camera traps to estimate litter size and cub recruitment.

1168 In combination with population and vital rates estimates, CDFW will use other metrics to
1169 inform its adaptive management of black bears as described in Chapter 6. These metrics
1170 include those CDFW has previously used in the absence of robust population estimates: 1)

1171 the average (or median) age of female bears ascertained from the age distribution data
1172 used in the IPM, and 2) the percentage of harvested bears that are females ascertained
1173 from harvest success reporting required of hunters (CDFW 1998). When possible, CDFW
1174 staff will confirm reported bear sex when handling bears to extract teeth. This approach of
1175 using harvest-based metrics to guide sustainable levels of hunter harvest has been used
1176 by many other state wildlife agencies throughout North America (IDFG 1999, WGFD 2007,
1177 NYDEC 2014, Allen et al. 2018a, Allen et al. 2018b).

1178 CDFW maintains a database of harvest statistics of annual black bear tags sold and the
1179 mandatory reporting information on harvest locations and dates. Besides using this
1180 information to inform population monitoring, the information is used to assess factors
1181 affecting hunter success at the BCR scale.

1182 **Chapter 5. Other Data for Informing Conservation and**
1183 **Management**

1184 **5.1 Genetic Diversity and Connectivity**

1185 Brown et al. (2009) found that genetic diversity among California black bears is substantial
1186 and similar to that of other states (Brown et al. 2009, Clarke et al. 2001, Paetkau et al.
1187 1998, Paetkau and Strobek 1994). However, given the age of this study, these estimates
1188 require an update. The California Department of Fish and Wildlife (CDFW) is currently
1189 collaborating with the University of California, Santa Cruz to conduct a statewide genomic
1190 study to address issues of genetic diversity, population structure, and adaptive
1191 differentiation. This study will serve as a baseline assessment that can be used to evaluate
1192 genetic diversity in subsequent years. Given the substantial genetic diversity, minimal
1193 population structure, and high connectivity among California black bears, there are
1194 currently few conservation concerns regarding genetics. Given the time lag between when
1195 a population may experience anthropogenically induced reductions in size and/or
1196 connectivity versus when the genetic effects of such events become detectable, statewide
1197 efforts to re-estimate genetic diversity should every 10-20 years. On that schedule, CDFW
1198 scientists should estimate standardized measures of genetic diversity (e.g.,
1199 heterozygosity, allelic richness, etc.), as well as re-evaluate genetic population structure.
1200 Both can provide insights regarding whether anthropogenic activities have significantly
1201 fragmented available habitat or reduced population size. To facilitate these updates,
1202 CDFW will continue to build and maintain a DNA archive for black bears throughout the
1203 state.

1204 **5.2 Movement Ecology and Connectivity**

1205 California Assembly Bill 2344 (Safe Roads and Wildlife Protection Act) was enacted in 2022
1206 and provides new authority and funding to support the evaluation of wildlife connectivity
1207 across roads, and other barriers, to benefit wildlife populations and reduce vehicle
1208 collisions. In part in response to these priorities, CDFW will include detail in a black bear
1209 monitoring plan (see Section 4.4) to guide how most efficiently to place GPS collars on
1210 black bears to better understand their spatial ecology and vulnerability to road collisions.
1211 For example, autocorrelated kernel density estimators can be used to estimate bear home
1212 range sizes and understand factors associated with differences in those ranges (Fleming et
1213 al. 2015), and GPS collar data will also allow for detailed analyses of black bear movement
1214 and habitat selection through methods such as Brownian bridge movement models and

1215 integrated step selection functions (Koehler and Pierce 2003, Thurfjell et al. 2014). Results
1216 from these analyses will allow for better predictions of where black bear road crossings are
1217 the most likely, which will help inform mitigation efforts like the installation of wildlife road
1218 crossings (Zeller et al. 2020).

1219 A secondary purpose of the GPS collars will be to estimate survival rates, and how they
1220 change over space and time. As noted in Section 4.2, vital rates are a key source of
1221 information included in the IPM to monitor black bear populations.

1222 Additionally, in 2022, the CDFW initiated a project to document the space use of black
1223 bears involved in human-black bear conflict (HBC) and cubs released from rehabilitation
1224 facilities. Over the next 3-5 years, fine-scale habitat use data (i.e., hourly detections) will
1225 be collected from up to 250 black bears fitted with GPS collars. Collars fitted to adults will
1226 last for 2 years and collars fitted to yearlings or small juveniles will last for 9 months to
1227 accommodate increase in body size. This data can be used to inform habitat selection in
1228 relation to environmental factors (e.g., forest cover, riparian areas, fires, droughts, etc.),
1229 improve understanding of black bear road crossings, and evaluate the ability of non-lethal
1230 management tools for altering conflict behavior.

1231 CDFW and other researchers are increasingly placing cameras at wildlife crossings below
1232 or above roads to document and evaluate the effectiveness of these structures for
1233 facilitating wildlife connectivity (Ng et al. 2004, Caldwell and Klip 2020). Cameras in these
1234 settings provide information on the species using connectors, the times of day they are
1235 more likely to use these structures, and interactions among species, for instance whether
1236 prey species such as deer are at greater risk of ambush by predators such as mountain
1237 lions. These data could help inform an expanded assessment of the importance of
1238 underpasses and overpasses to reduce vehicle collisions with black bears and the degree
1239 to which black bears alter the behavior of other species using these structures.

1240 Roadkill data is also relevant to mitigating traffic collisions and other aspects of wildlife
1241 conservation and management (Schwartz et al. 2020). The California Department of
1242 Transportation maintains a wildlife roadkill database including species, date, road
1243 number, and mile marker location. Further, the UC Davis Road Ecology Center compiles
1244 some of these data and other sources of citizen science wildlife roadkill observations in
1245 another database (Shilling and Waetjen 2015, <http://wildlifecrossing.net/california>).

1246 **5.3 Disease**

1247 Collecting biologic samples and associated metadata (age, sex, date, location, etc.),
1248 whether for archive or immediate analysis, is an important tool to inform managers about
1249 the health, disease status, and HBC involvement of individual animals within the context of
1250 populations. If sample collections are from a large and diverse enough subset of one or
1251 more populations, results either from a point in time or, better yet, across time can
1252 collectively provide significant information on health and disease status of populations.
1253 Trends in results could indicate changes in population health. CDFW and its partners
1254 maintain multiple tissue sample archives including serum, whole blood, hair, formalin-
1255 fixed paraffin embedded tissues, and various fresh tissues collected from black bear
1256 mortality investigations, management actions, and hunter harvests. CDFW will continue to
1257 collect and archive these samples so they will be available for future use. The value of
1258 maintaining this archive is that if a health or disease related issue does emerge, samples
1259 are available that could be used to assess over space and time, giving managers a better
1260 understanding of any potential impacts.

1261 **5.4 Animal Welfare**

1262 One of the primary animal welfare concerns of the CDFW is the disposition of orphaned
1263 black bear cubs. Up to 30 cubs are assessed for care annually by CDFW veterinarians for
1264 placement in one of currently four permitted rehabilitation facilities in the state. Monitoring
1265 of these bears following release from rehabilitation facilities with GPS collars began in
1266 2022 and will continue for the next 3-5 years. Information on short-term (i.e., 9-month)
1267 survival, causes of mortality, and conflict behavior of the animals will be compared to that
1268 of wild bears to evaluate and/or improve practices for management of orphaned cubs.

1269 **5.5 Human Interactions with Black Bears**

1270 CDFW will continue to maintain and use its Wildlife Incident Reporting (WIR) database to
1271 monitor HBC trends. The public can submit reports online directly to the WIR, or a CDFW
1272 staff member can enter a report on the public's behalf. The report consists of the date the
1273 incident occurred, the species of wildlife involved, the address of the property, the
1274 approximate GPS coordinates, and a brief description of the incident.

1275 CDFW's black bear policy defines different types (categories) of bear incidents requiring a
1276 response:

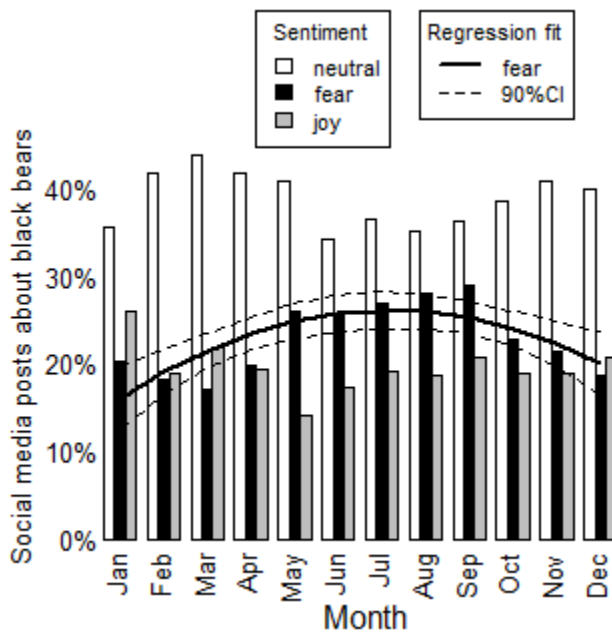
- 1277 1) **Conflict bear:** A catch-all term for any bear that requires response due to its
1278 behavior or situation, including animal welfare bears, habituated bears, and “no
1279 harm/no foul” bears which may require assistance returning to nearby habitat.
- 1280 2) **Depredation bear:** A bear that is threatening to, damaging, or destroying property
1281 for which a revocable depredation permit has been requested and can be issued in
1282 accordance with the Fish and Game Code.
- 1283 3) **Public safety bear:** A bear demonstrating aggressive action that has resulted in
1284 physical contact with a human; or a bear exhibiting an immediate threat to public
1285 health and safety.

1286 Once a WIR report has been submitted, it is reviewed by a CDFW staff member. If the
1287 incident warrants further investigation or action, the staff member will follow up with the
1288 reporting party and often perform a site visit to inspect the situation firsthand. For black
1289 bears, this may involve providing outreach on coexistence. If the incident is a depredation
1290 incident, the depredation permit process may be initiated per the steps in the Black Bear
1291 Depredation Policy (CDFW 2022a).

1292 Human dimension studies on the quality of human interactions with wildlife including
1293 black bears are led by a CDFW social scientist. These studies will focus on both the
1294 general public, particularly those living in black bear habitat, and California’s black bear
1295 hunters. Specifically, understanding the factors influencing effective implementation by
1296 the public of preventative measures to reduce human black bear conflict will be important
1297 for effective conservation (Baruch-Mordo et al. 2011). Further research on how the
1298 California public values black bears will be necessary to better estimate and manage
1299 social tolerance levels for the species in different settings and help set conservation goals
1300 accordingly (Vaske et al. 2022, Delie et al. 2023). Additionally, understanding the
1301 experiences of California’s black bear hunters will be useful for predicting hunter effort and
1302 evaluating the role of hunter harvest in black bear management and conservation. Such
1303 work can help identify the behavior of hunters and the barriers and limitations hunters
1304 face. Hunter satisfaction surveys are the easiest surveys for CDFW to perform because
1305 CDFW has the contact information of hunters purchasing a black bear tag or hunting
1306 license. For most surveys of the general public, CDFW would need to purchase a survey
1307 panel or sample to have a scientifically robust sample.

1308 CDFW is beginning to explore methods for analyzing social media posts about wildlife to
1309 widen its understanding of human-wildlife interactions beyond hunting. For example,

1310 CDFW has worked with data science interns at the University of San Francisco to extract
 1311 and analyze posts about black bears from X (formerly known as Twitter) throughout
 1312 California during 2010-2022. A preliminary analysis of emotional sentiment using data
 1313 science methods suggests that the predominant sentiments towards black bears were
 1314 ambivalence (38%), fear (24%), and joy (19%) and that there were seasonal shifts in the
 1315 relative frequency of these sentiments (Fig. 12, Ai 2023). CDFW will attempt to improve
 1316 upon this analytical approach including expansion to other social media platforms.



1317
 1318 Figure 13. Analysis of emotional sentiments expressed within black bear social media posts from California
 1319 during 2010-2022. Data science methods were applied to remove non-wildlife related tweets (e.g., Black
 1320 Bear Diner) and to infer emotional content of phrases and sentences. Results suggest negative sentiments
 1321 peaked during summer when human wildlife conflict incidents are more prevalent (Ai 2023).

1322 **Chapter 6. Adaptive Management**

1323 **6.1 Conserving Abundant Black Bear Populations and their Habitats**

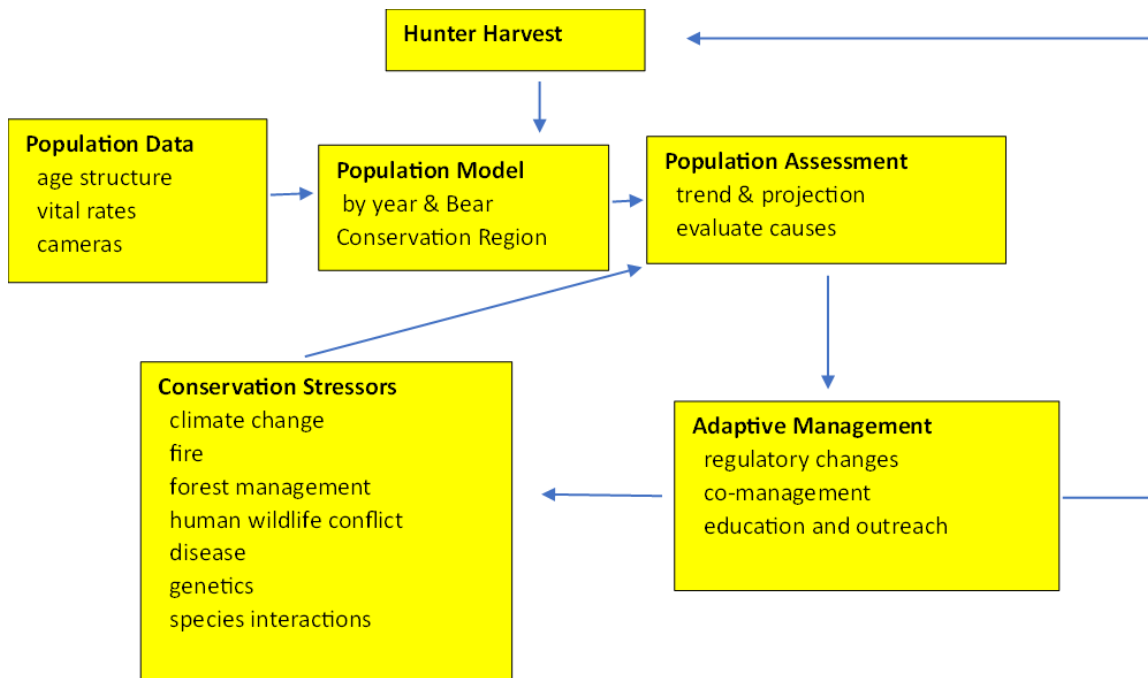
1324 An ability to estimate and monitor bear population abundances statewide and regionally
1325 constitutes the foundation of the California Department of Fish and Wildlife's (CDFW)
1326 approach to meeting its conservation goals for black bears. CDFW intends to apply
1327 population information within an adaptive management framework for guiding, supporting,
1328 and communicating decisions affecting hunting, human-black bear conflict (HBC), and
1329 other conservation actions for black bears (Walters 1986, Fig 13). This adaptive approach
1330 will provide CDFW with the flexibility to adjust its approach to black bear conservation
1331 based on the most up-to-date data and evidence.

1332 As detailed in Chapter 4, CDFW will monitor black bear population totals and their trends
1333 within each Bear Conservation Region (BCR). Consistent with the goal to maintain
1334 abundant bear populations, if there is a conservation concern about a population decline
1335 or low population, CDFW will use the integrated population model (IPM) to follow up with
1336 an evaluation of vital rates, associations with specific stressors (e.g., harvest, habitat,
1337 climate, food availability, fire, etc.), and related conservation metrics (e.g., genetic
1338 diversity, disease). If concern remains, CDFW would apply the IPM to simulate expected
1339 future conditions and provide a population viability analysis to help quantify the
1340 conservation risk (Penman et al. 2022). CDFW would rely on findings from these analyses
1341 and assessments to inform any recommendations to the Fish and Game Commission
1342 ("Commission") about regulatory changes including (but not limited to) hunting levels,
1343 methods, and seasons. CDFW would also use its findings to inform other potential
1344 conservation responses, including initiating new research and collaborating with external
1345 partners (federal and state agencies, tribes, non-government organizations, private
1346 landowners) on developing conservation approaches which could include forest and fire
1347 management strategies for improving black bear habitat.

1348 Whereas there is a goal to maintain abundant black bear populations, high black bear
1349 densities can exacerbate HBC, adversely impact other wildlife species, and increase
1350 incidence of bear diseases (see Chapter 3 for greater detail). If there is a concern about
1351 black bear overpopulation within a BCR, CDFW would conduct similar analyses as
1352 described in the previous paragraph. CDFW would use this information to help assess
1353 whether and how overabundance contributes to the concern as it pertains to its
1354 conservation goals for black bears. CDFW would then evaluate and appropriately

1355 implement management actions for addressing the concern. These actions include
1356 application of educational and public outreach approaches included in CDFW’s policy for
1357 addressing HBC (CDFW 2022a) and working with local municipalities and other groups to
1358 provide expanded access to secure waste disposal and other infrastructure that reduces
1359 the availability of anthropogenic food sources to black bears (Johnson et al. 2018). CDFW
1360 will use its IPM-based population monitoring approach to evaluate whether reduced levels
1361 of HBC lead to reductions in recruitment and population size. Specifically, CDFW will
1362 coordinate vital rates monitoring among groups of black bears representative of different
1363 levels of HBC. This will help CDFW assess whether reducing attractant-based HBC leads
1364 to either lower regional population size via reduced recruitment or lower local density via
1365 reduced immigration. CDFW would also evaluate the application of non-lethal strategies
1366 for managing the potential effects of black bear predation on ungulates and other species
1367 of management or conservation concern. For example, relocation of black bears off elk
1368 (*Cervus elaphus*) calving grounds has been used to improve calf recruitment (Yarkovich et
1369 al. 2011).

1370 As there is anecdotal information suggesting black bears have recently expanded their
1371 range in some areas of California (Section 3.2) effecting a potential for increased hunting
1372 opportunity and increased HBC, CDFW will prioritize analysis of occurrence (e.g.,
1373 cameras) and movement (e.g., GPS collars) monitoring in these areas. If necessary, CDFW
1374 will create additional BCRs to reflect the changing distribution of black bear populations.



1375

1376 Figure 14. Adaptive management steps for using population data, and other information, to inform
 1377 conservation actions for black bears in California.

1378 **6.2 Conserving Genetically Diverse Black Bear Populations**

1379 By monitoring and reassessing black bear genetic diversity every 10 to 20 years (Section
 1380 5.1), CDFW will be able to determine if anthropogenic activities have significantly
 1381 fragmented habitat and limited gene flow. Should such situations occur, CDFW will use
 1382 other existing and future data sources (e.g., from GPS collared individuals, road-kill
 1383 surveys, etc.) to identify locations where mitigation projects to improve connectivity (e.g.,
 1384 highway crossing structures, habitat corridor protection and enhancement) could occur.

1385 **6.3 Conserving Disease-Resilient Black Bear Populations**

1386 Black bear populations currently appear to be stable and disease-resilient in California.
 1387 CDFW will continue to opportunistically surveil black bears for emerging health or disease
 1388 concerns through mortality investigations and routine sample collections from
 1389 management actions or conflict black bears. In particular, CDFW will research idiopathic
 1390 encephalitis in black bears, which can substantially alter black bear behavior and has
 1391 been suggested to exacerbate HBC (Sinnott et al. 2022)

1392 **6.4 Providing Black Bear Hunting Opportunities**

1393 Consistent with Fish and Game Code (FGC) Section 1801, CDFW will analyze and assess
1394 black bear population data, and other sources of information including data on hunter
1395 opportunity and success, to inform any recommendations to the Commission about
1396 changes to hunting regulations (e.g., tag limits, seasons, methods of take).

1397 CDFW's primary analytical tool for determining sustainable harvest levels would be the
1398 IPM combined with simulation of the future population trajectory under different harvest
1399 scenarios.

1400 As CDFW will be monitoring black bear populations at the BCR scale, it makes sense to
1401 manage hunting levels, seasons, and methods of take at this scale. Regulatory changes
1402 (Title 14 CCR) would be required for this to be possible. This is because current regulations
1403 set a 1,700 black bear annual harvest limit at the state level.

1404 CDFW will continue to promote hunter ethics through hunter education activities.

1405 **6.5 Managing Human-Black Bear Conflict and Consideration of Animal Welfare**

1406 Although concerns about HBC and conserving abundant populations are linked (see
1407 Section 6.1), management of HBC is a broader issue that is largely addressed in a separate
1408 CDFW (2022) policy document.

1409 This policy places a high priority on animal welfare. Specifically, the policy prioritizes use of
1410 non-lethal, corrective actions (e.g., eliminating attractants and adding bear-proofing
1411 structures) before authorizing depredation permits for killing conflict bears. The annual
1412 number of black bears taken under depredation permits has decreased since 2017 and
1413 averages 60 bears per year, which amounts to <0.1% of the state population.

1414 Additionally, CDFW will continue to coordinate with rehabilitation facilities around the
1415 state to ensure humane and effective veterinary care for black bears recovered during
1416 wildfires and other circumstances. Further, CDFW veterinarians will continue to lead
1417 review of capture plans required for research investigations that include the capture and
1418 temporary immobilization of black bears to place GPS collars or for other purposes. These
1419 capture plans safeguard animal welfare by specifying methods of capture, proper use of
1420 immobilization drugs, and monitoring of the physical and psychological health of captured
1421 animals.

1422 CDFW will continue to consider animal welfare in its planning activities and regulatory
1423 change proposals affecting regulated hunting. Besides conserving abundant, genetically
1424 diverse, and disease-resilient bear populations, and consistent with efforts to promote
1425 hunter ethics (see section 6.4), CDFW will consider the effects of hunting seasons and
1426 methods of take on animal welfare.

1427 **6.6 Communication and Outreach About Black Bears**

1428 CDFW will produce an annual report on the status of California black bear populations at
1429 the BCR scale which it will post on its website by September 15th each year. The report will
1430 include estimates and trends for population sizes, vital rates, and harvest statistics. The
1431 report will discuss any emerging conservation or management issues and identify areas
1432 requiring new, focused research to further investigate those issues.

1433 Additionally, the CDFW Statewide Black Bear Coordinator will regularly lead meetings of a
1434 black bear working group (i.e., CDFW regional biologists and subject area experts) to
1435 discuss black bear conservation issues and implementation of this plan.

1436 **6.7 Co-management of Black Bears with Tribes and other Partners**

1437 Consistent with policy (CDFW 2014), CDFW will continue to notify and consult with Tribes
1438 regarding any regulatory change proposals affecting black bears. CDFW will also prioritize
1439 co-management opportunities with Tribes including actions that address comments
1440 summarized in Table 1. Other potential opportunities include funding to help support and
1441 sustain Tribal wildlife conservation and research programs and cooperation on population
1442 monitoring of black bears.

1443 CDFW will actively seek opportunities to partner with Tribes, federal and state agencies,
1444 hunter and animal welfare interest groups, and others to collaborate on 1) research
1445 studies, 2) habitat improvement activities (e.g., prescribed fire, forest management, food
1446 availability, movement connectivity, climate adaptation), and 3) human infrastructure
1447 programs (e.g., increasing access to secure waste disposal, electric fencing, and
1448 educational outreach about their proper use) that are likely to benefit stable black bear
1449 populations and minimize HBC.

1450 **6.8 Periodic Review and Updating of the Black Bear Plan**

1451 CDFW will review and update this plan in its entirety every 10 years. CDFW will update
1452 individual sections as necessary.

1453 **Chapter 7. Research, Resources, and Organizational**
1454 **Support Required for Plan Implementation**

1455 **7.1 Data Collection**

1456 This conservation plan provides a general summary of the types of data that will need to be
1457 collected for use in population modeling and other sorts of analyses for informing effective
1458 conservation of black bears in California. The California Department of Fish and Wildlife
1459 (CDFW) will also need to develop a black bear monitoring plan that details the logistics for
1460 sustaining collection of these data over time. Such a plan could take 1-2 years to develop;
1461 it would need to include specifics on the locations of the 10-15 regional study areas where
1462 recruitment and survival data would be collected and where genetic spatial capture-
1463 recapture surveys would occur for validating population estimates from the integrated
1464 population model (IPM). The logistical considerations would include equipment, samples
1465 sizes, the scheduling of surveys, and the CDFW staff in Regions and Headquarters required
1466 to administer this work. CDFW would also need to identify suitable and sufficient sources
1467 of funding to cover the anticipated actions.

1468 In the first few years of implementing new and expanded black bear population monitoring
1469 efforts, CDFW will need to prioritize research of new survey and analytical methods,
1470 especially for vital rates and the most efficient design of genetic spatial capture-recapture
1471 studies. Currently, we rely on the use of the teeth from harvested bears as our primary
1472 source of information on age distribution. However, the estimation of DNA methylation
1473 levels is an emerging and potentially promising alternative method that CDFW will
1474 investigate. Higher DNA methylation levels, which can be estimated from blood, hair, and
1475 tissue samples, are associated with older age in mammals (Nakamura et al. 2023).

1476 **7.2 Data Management**

1477 Historically, CDFW and other wildlife agencies have placed greater emphasis on gathering
1478 wildlife survey data than on planning for management and analysis of that data once
1479 collected (DeWan and Zipkin 2010, Scotson et al. 2017). CDFW will require dedicated staff
1480 to manage and quality check these data in a timely manner.

1481 Data storage and workflow management pipelines are also important considerations for
1482 ensuring data integrity, security, and ease of use (Brousil et al. 2023). CDFW is currently
1483 developing its data science capabilities through contracts to help manage its camera trap
1484 data (e.g., Wildlife Insights) and sound recorder surveys for birds and bats (e.g., UC

1485 Berkeley). CDFW will also need to investigate similar approaches for telemetry and genetic
1486 spatial capture-recapture data. The effectiveness of data sharing practices will also need
1487 to be considered (Urbano and Cagnacci 2021), especially since numerous entities outside
1488 of CDFW use camera traps and other survey methods (e.g., roadkill counts) that generate
1489 data that would likely be useful to big game species conservation in California. Pooling
1490 large data sets for improving statistical modeling will require development of collaborative
1491 relationships that are ultimately formalized through data sharing agreements and
1492 memorandums of understanding. For example, it is likely that the 10-15 black bear study
1493 areas proposed under this conservation plan will require collaboration with Tribes, other
1494 state and federal agencies, private landowners, and non-government organizations.

1495 **7.3 Data Analysis**

1496 Modern computing allows for more robust modeling and stronger scientific inferences by
1497 combining data from multiple sources and adjusting for uncertainties and biases in the
1498 sampling methods (Kery and Royle 2016). One of the challenges is that these analyses are
1499 often highly complex, requiring advanced statistical expertise. CDFW currently has a full
1500 time Quantitative Ecologist to guide and advise on population modeling of big game
1501 species, but additional modeling support may be required to expedite analytical work for
1502 black bears and other big game species in a timely manner in response to conservation
1503 decisions that arise during the adaptive management process (Fig. 13).

1504 Computing speed is often a constraint on the efficiency and effectiveness of solving
1505 complex statistical models that include spatial data or multiple sources of data (de
1506 Valpine et al. 2017, Turek et al. 2021). It may be necessary to work with university
1507 researchers to customize software for improving the efficiency, performance, and
1508 scalability of the IPM and spatial capture recapture models (e.g., Nimble package for R
1509 software). CDFW also may need to invest in additional computing power for use by staff
1510 running complex models.

1511 **7.4 Collaboration and Co-management**

1512 The CDFW Statewide Black Bear Coordinator will lead collaboration and co-management
1513 activities, but support from various other functions will be critical to success of these
1514 efforts. Co-management of habitat conditions through forest and fire management that
1515 require outreach to Tribes, and other state (e.g., CalFire, State Parks) and federal agencies
1516 (e.g., US Forest Service, National Parks) are best achieved in consideration with the needs
1517 of multiple wildlife and plant species. This highlights the importance of a broader, co-

1518 management approach within CDFW that is coordinated across species, habitats, and
1519 programs.



1520

1521 Photo: CDFW Ecoregional Biodiversity Monitoring Project, Northern Region.

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