

EVALUATION OF THE POTENTIAL EFFECTS OF SPORT HUNTING ON CALIFORNIA BLACK BEARS

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Abstract: Requirements to comply with environmental laws require annual evaluation of the impacts of hunting on black bear (*Ursus americanus*) and the environment in California. Historical management was custodial and earlier investigations indicated that illegal kill was a major mortality factor. Since 1982, mandatory tag returns and presentation of skulls for aging have increased the amount and quality of data. The level of illegally killed bears has declined since dog training was prohibited in bear habitat during spring and summer. Hunting and harvest quotas have been established. Current harvest levels are thought to be about 8% of the population. Data indicate that hunting mortality has little negative effect on the population and hunting mortality is thought to be compensatory.

Int. Conf. Bear Res. and Manage. 9(1):231-235

Environmental laws such as the California Environmental Quality Act (CEQA), controversy over sport hunting of black bear, and litigation by animal protection groups require the California Department of Fish and Game to annually analyze the effects of sport hunting on black bear and the environment. Failure to prepare adequate environmental documents resulted in court-ordered cancellation of the 1989 bear season. The 1990 archery bear season was also canceled when the court held that the 1990 document failed to adequately deal with archery wounding loss as well as pain and suffering of individual animals. The documents that analyzed the environmental impact of bear hunting with firearms in 1990 and of hunting with firearms and archery equipment in 1991 were ruled adequate by the court. This paper discusses the development of an annual environmental document and some of the information used.

The annual evaluation of the potential effects of sport hunting on black bear includes an assessment of the effects of previous hunting, projected effects of future or proposed hunting, long-term trends in habitat availability, and the cumulative effects of hunting. The effect of factors such as wildfire and weather patterns on black bear are also included in the analysis. This evaluation provides a benchmark for comparison among years and in order to establish trends from which population and habitat status can be inferred. The effects of proposed hunting programs are also projected for several decades. The CEQA requires the development and analysis of reasonable alternatives to the proposed action. In compliance with that requirement, the annual environmental document develops alternative strategies for sport hunting of black bear. Alternatives that are presented to the California Fish and Game Commission include a preferred alternative as well as alternatives with more restrictive

as well as more liberal harvest levels. The CEQA also requires that a no-project (i.e., no-hunt) alternative be included in any analysis. Annually, the array of alternatives is presented to the commission which then adopts one alternative as the sport-hunting program.

BLACK BEAR MANAGEMENT IN CALIFORNIA

Sport hunting of black bear in California has been regulated since 1948 when seasons and bag limits were established. In 1957, hunters were required to purchase a tag and successful hunters were required to report the sex and locality of kill. Hunter surveys indicated that nonreporting by successful hunters was as high as 65% in some years (California Fish and Game 1991). From 1948 until 1982, bear management was basically custodial and consisted mostly of compiling annual kill figures and hunter effort information (Table 1). There was also a summer pursuit season that provided for the use of dogs to trail bear as long as bear were not killed or injured.

Increased departmental and public concern about bear populations stimulated field studies in the 1970s and 1980s. Studies were directed at both hunted and unhunted populations. It became apparent that illegal hunting had a significant impact on some populations and may have exceeded recruitment resulting in reduced populations in some areas (Burton 1977, Weaver 1979, Sitton 1982). Continued field investigation (Piekielek and Burton 1975, Kellyhouse 1977, Graber 1982, Koch 1983) indicated that better information on populations and mortality were needed. During this same period, enforcement agencies conducted undercover operations and found that considerable illegal activity was occurring during the dog training only season (California Fish and Game 1991).

Table 1. Black bear harvest statistics reported in California, 1957-90.

Year	Bears reported killed	Kill/1,000 hunter days	Percent females killed
1957	920		39.02
1958	635		44.09
1959	1,016		42.03
1960	925		47.78
1961	841		50.54
1962	594		45.12
1963	685		47.88
1964	670		45.82
1965	1,281		45.28
1966	1,054		41.84
1967	935		42.35
1968	638	3.764	45.30
1969	871	4.623	43.97
1970	555	3.286	44.68
1971	559	4.523	38.28
1972	626	5.973	40.10
1973	767	4.806	38.07
1974	632	3.928	40.51
1975	553	3.936	NA. ^a
1976	486	3.542	45.88
1977	451	3.121	39.69
1978	655	6.609	37.10
1979	731	6.521	36.25
1980	655	5.911	40.92
1981	766	6.302	38.64
1982	783	7.764	32.69
1983	601	8.506	36.94
1984	770	12.754	38.05
1985	1,138	13.196	39.37
1986	1,035	17.616	41.26
1987	1,448	20.155	33.56
1988	1,359	12.80	37.38
1989 ^b	0	0	0
1990	1,187	14.065	37.35
1991	1,434	NA. ^a	35.29

^a Data are unavailable.^b No hunting season was held in 1989.

In 1982, a mandatory tag return reporting system was initiated in which all hunters, successful or not, were required to return their bear tag. Mandatory presentation of hunter-killed bears for collection of a premolar was also required in 1982. In 1985, the dog-training-only season in the spring and summer was eliminated, and reported bear kill rose significantly.

INFORMATION COLLECTED AND OBSERVED TRENDS

Information that is collected from hunters and hunter-killed bears provides the number of bears killed, age and sex composition of hunter-killed bears, locality of kill, hunter effort, and hunter success. Projections of trends in available habitat are also used to assess long-term cumulative effects of hunting. Annual reports of depredation complaints and numbers of nuisance bears killed are also maintained. The extent of illegal activity is inferred from the type and number of bear violations that are reported during the year.

Annual Bear Kill Information

Reports of hunter-killed bears have been gathered since 1957 (Table 1). Average number of reported hunter kills since 1982 is 1,084 bears, which is significantly higher ($P > 0.01$) than the average reported kill of 740 bears from 1957 to 1981. Changes in regulations, particularly the use of dogs for pursuit and taking of bear, are considered to be major factors in changes observed in reported kill since 1957.

The evaluation of impacts and trends largely utilize kill data that have been gathered since 1982 when mandatory reporting was initiated. With the exception of regulations that have limited the use of dogs in areas of bear habitat (1985), regulations have remained essentially unchanged since then. Hunter effort information has been collected in the same manner since the 1960s and is believed to be a reliable long-term indicator of hunter effort and success rates.

Since 1985, significantly higher ($P > 0.01$) annual kills have been reported during years that the dog training season was prohibited in bear habitat. The reduced illegal activity associated with the prohibition of the dog-training season is believed to be responsible for higher reported annual kill because the prohibition was the only regulatory change that year. Total hunting mortality has apparently remained relatively constant, as much of the previous illegal and unreported kill is now being reported during the hunting season.

Age and Sex Information

Hunters are required to report the sex of the bear they kill and present the skull for the removal of a premolar by a department employee. The age of hunter-killed bears is estimated by cementum analysis. The annual evaluation of the effects of hunting on black bear include the analysis of these sex and age data.

Since 1957, 35.3% of the total kill has been females. The composition of females in the harvest has ranged from 51% in 1961 to 33% in 1982. There has been a significant reduction in the percent of females in the harvest since 1957 ($P < 0.05$) (Fig. 1).

Reliable age information has only been gathered since 1982. Subadult age classes (<4 years) predominate the kill. Sample sizes of all hunter-killed bears are large and have ranged from 31.0% to 90.5% and have averaged 70.3% of the annual reported kill since 1982. Median ages of the kill have increased since 1982.

Hunter Effort and Hunter Success Information

Annual hunter survey questionnaires are mailed to approximately 4% of the hunting license buyers in California. Hunters are questioned about the species hunted, the number taken, areas hunted, and the amount of time spent in the field. Information provided by the hunter questionnaire is used to develop catch per unit effort analyses. Catch per unit effort has increased dramatically while hunter numbers and total hunter effort has decreased (Fig. 2).

Habitat Information

California has an estimated 46,000 square miles of bear habitat. In California, bears prefer vegetation types with a conifer and hardwood component with a

mixture of shrubs (Grenfell and Brody 1983). Because these types are largely in public ownership or have value as timberlands to private owners, conversions to uses that eliminate habitat for bears are not widespread. For the most part, conversion of wildlands to urban uses in California occurs in annual grasslands or valley foothill hardwoods adjacent to existing urban areas (FRAPP 1988); these areas have little value as bear habitat (Mayer and Laudenslayer 1988).

Long-term trends for bear habitat are developed from a resource-assessment program (FRAPP 1988) and the projected conversion of habitat types through a simulation model for forest and rangeland outputs, CALPLAN (Davis et al. 1987). Habitat information is not gathered on an annual basis and is not an integral component of the annual evaluation process to comply with the CEQA. Projected long-term trends in habitat are used for cumulative-impact analysis in the environmental document.

CALPLAN simulation projections have been made for the period 1980-2000. Results of this analysis indicate that there is no significant reduction in the acreage of statewide bear habitat expected for that period.

USE OF INFORMATION COLLECTED

Miller (1989) indicated that information from hunters was important for management of exploited populations and most useful when used with other information such as trends in habitat, in order to develop objective management. Miller also cautioned about the misinterpretation of commonly gathered information such as sex or age composition of bear harvests. Garshelis (in press) discussed the pitfalls and inherent

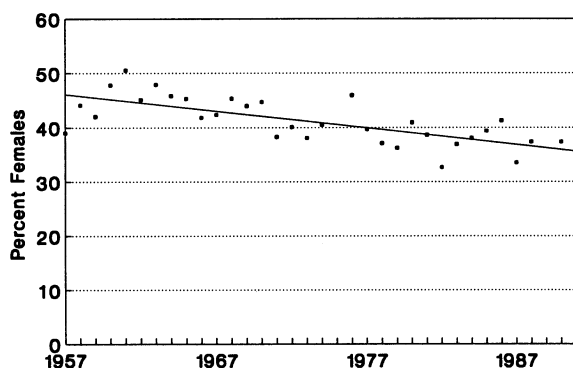


Fig. 1. Percent female black bear in California harvest, 1957-90. No hunt was held in 1989.

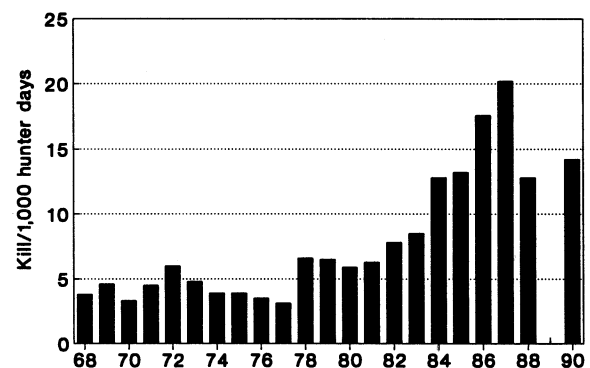


Fig. 2. Black bear kill per 1,000 hunter days in California, 1968-90.

problems in assessing population status and trends from commonly gathered data such as age and sex composition of hunter-killed bears. Garshelis also concluded that bear management was as much an art as a science and that the intuition of experienced managers had value in determining management programs. With these admonitions in mind, we annually plunge into a process that integrates the use of data collected from hunters and hunter-killed bears, bear depredation statistics, computer simulation models, the alchemy of intuition, and the requirement of environmental law. The information that we gather is used as the basis for the assessment of the effects of hunting as well as to make projections regarding the environmental impact of alternatives to current hunting programs. A computer simulation model POPMODBB (Barrett 1986) is used to assess the impacts of current hunting and project impacts of alternative hunting strategies on bear populations. We concur with Miller (1990) who assumes that productivity and survivorship are influenced by bear density in populations existing at, or near, carrying capacity. The model assumes that mortality is compensatory up to a point (e.g. until total mortality exceeds the threshold of maximum sustained yield [MSY]). The model provides post-harvest populations and survival coefficients, which are used to predict the effects of hunting on the population.

Caughley (1977) listed 3 general goals of population management as: (1) conservation, which is designed to increase density or population, (2) exploitation to take a sustained yield, and (3) treatment to reduce density or stabilize numbers and rates of increase. The management of black bear in California is somewhat of a hybrid between conservation and sustained yield. Management goals of the department are to provide for the maintenance of bear populations for their ecological value as well as public benefits, including hunting. The social pressures that realistically shape the hunting program preclude management that would provide for harvest levels approaching MSY. Conversely, the absence of any harvest would not be in keeping with department objectives and mandates.

Analyses of the available data indicate that the current sport-hunting program for black bear in California is not adversely effecting the population. Observed trends of many parameters used in the evaluation process indicate that California's bear population may be increasing. Evidence used to reach these conclusions is a result of the integrated assessment of the parameters previously discussed. The observations are:

1. Reported kill has increased significantly.

2. Illegal kill has declined with decreased opportunity to chase bear with trailing hounds during the spring and summer.

3. Hunter effort and hunter numbers have declined but catch per unit effort has increased significantly.

4. The percent of females in the harvest has declined significantly.

5. Median age of hunter-killed bears has increased since 1982.

6. The number of depredation incidents has increased since 1982.

The current hunting program in California provides for the limited take of black bear. A quota of 15,000 bear tags are available for a 79-day general season that begins on the second Saturday in October and a 23-day archery season that begins on the third Saturday in August. When 1,250 bear are reported taken, the season is closed. The reported kill of bears exceeded 1,250 in 1991 (Table 1) and the season was closed after 72 days. It is illegal to kill cubs or females with cubs.

Population size for the state has been estimated at between 16,000 and 18,000 bears. Population figures are estimated by the use of age and sex data from reported hunter kill (Fraser et al. 1982).

Hunter-caused mortality is estimated to be about 8% of the population. Illegal harvest, estimated from law enforcement and computer simulation is thought to be approximately 25% of the reported legal take or about 300 bears. Since 1982, the number of bear depredation incidents has increased, and since 1987, an average of 68 nuisance or depredation bears per year have been killed.

SUMMARY AND MANAGEMENT RECOMMENDATIONS

In compliance with the requirements of the CEQA, the environmental impact of hunting in California is analyzed annually. This analysis is conducted for each species that is hunted and a separate environmental document is developed for species such as black bear. Along with data gathered from hunter-killed bears, the analysis also includes the cumulative effects of habitat conversion.

Specific bear data that are collected include age, sex, locality of kill, date of kill, and hunter effort. These data are used to model the population and assess long-term trends. The analysis of these data indicates that black bear populations in California may be increasing. Habitat information is also modeled to assess long-term trends in habitat availability. Habitat data are gathered and maintained on a statewide scale.

The analysis integrates the assessments of population and habitat trends in order to develop an environmental document and alternatives within that document, and to predict the impact of implementation of a given alternative on black bear populations. Failure to conduct this process adequately has (1989) and can result in the loss of bear-hunting season.

California is 1 of 20 states with an environmental assessment law modeled after the National Environmental Policy Act (Bass and Herson 1992). Because of differences between state laws, the amount and type of information required and the analysis of that information may vary between states. In California, compliance with state law requires using information not generally collected in many states and provinces to monitor the effects of sport hunting on black bear. Some examples of discussions and disclosures that are part of the analysis and document in California include the effects of land-management practices on bear populations, the effects of black bear hunting on other species of wildlife, and the consideration of the welfare of individual animals.

In California as elsewhere, challenges to resource management activities such as bear hunting are increasing. Challenges, for the most part, are based on procedural or substantive requirements of environmental assessment regulations. If hunting is to continue, it is essential that responsible agencies develop additional information and processes that provide reliable assessments of the environmental effects of hunting programs in accordance with the level of analysis required by their respective state or provincial environmental assessment regulations.

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